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THE GOVERNMENT PATENT BILL.

The Government Bill now before the House of Commons is still engrossing a considerable share of public attention. This is not surprising, considering the extent and variety of the interests involved and the importance of the subject to all classes of the community. It is altogether a mistake to suppose that the various questions relating to the grant and maintenance of patents only affect a small minority, comprising inventors and patentees themselves, their professional advisers or patent agents, and the manufacturers of articles or substances of commercial application. We are all deeply interested in the matter, and there is not one of us who can safely isolate himself within his own restricted sphere, leaving to others a monoply in the discussion of this great question.

In considering the subject we find that—to put the case broadly and laconically—it chiefly resolves itself into two questions, distinct, but closely connected, viz. :—

1. What protection is the inventor to get ?
2. What is he to pay for it ?

Now, with regard to the first question, we are of opinion that the inventor who receives a monopoly from the Crown should have, if not a direct guarantee of its validity, at any rate a reasonable ground to believe that his patent is indefeasible, and not liable to be wrecked before the first hostile wind. In order to secure this desirable result it is indispensable that a thorough and stringent examination should be made, not only with regard to the form of the specification and the abstract patentability of its subject matter, but also as to the *novelty* of the latter. In the discussion which followed a paper on this subject, recently read before the Society of Arts by Mr. H. Trueman Wood, B.A., one of the speakers admitted, what we have pointed out in a previous article, that it is impossible to separate the question of subject matter from the attribute of novelty; but his reasoning led him to a conclusion directly the opposite of that which is its natural consequence, viz., that as the two things cannot be dissevered, therefore examination should be abolished altogether, except it be a mere perusal of the papers to ascertain that they are in proper form. We contend, on the other hand that, as the investigation of subject matter is inseparable from the inquiry into novelty, therefore the examination should not be *abandoned*, but *extended*, so as to embrace the attribute of novelty. We are informed, however, that this would be impracticable for two reasons. First, that as patents are now occasionally refused under the present system, the probability of refusal would be much greater under the new *régime;* and, secondly, that qualified examiners are not available.

With respect to the first point, we are by no means certain that a diminution in the number of patents would be an unmixed evil ; on the contrary, we are satisfied that for the Crown to accept large sums of money in return for such a mere shadowy protection to the patentee as he receives under the present system is a standing disgrace to the country ; and, further than this, that to grant patents upon frivolous pretexts, when the applicant is aware that he has no *bonâ fide* invention, is a fraud upon the industrial classes of the community. It is argued, however, that the evil is unavoidable, as competent examiners are not forthcoming. We are, therefore, asked to concede that what the United States and Germany can effect we are unable to accomplish in this country. And yet we are granting about 6,000 patents annually, which certainly argues an accumulative experience on patent matters in the nation. The fact is, it is altogether a question of pounds, shillings, and pence. If the Government are willing to hold out sufficient inducement to qualified persons to undertake the office of examiners the requisite number will be found.

We shrewdly suspect, however, that the real objection to the examination clauses arises from an apprehension not that examiners will not be forthcoming but that they would do their work only too well. It is worthy of observation that the opposition to examination is almost exclusively confined to patent agents, both patentees and manufacturers being favourably inclined to some system of the kind. This fact certainly detracts considerably from the force of the objections which are urged against it, and it should have some weight with those interested in the conduct of the measure now before the House.

We may also add that some most eminent legal authorities are strongly in favour of an examination limited to an inquiry into subject matter, among whom we may mention the chairman at the said meeting of the Society of Arts, Mr. R. E. Webster, the well-known Queen's Counsel ; but, as we have pointed out, to press the question to its natural consequence, an inquiry into subject matter must involve the consideration of novelty. We therefore recommend a thorough examination, which shall insure to the patentee a reasonable prospect of his patent being supported should it be litigated. It is of no use doing things by halves. If the examiners attempt to distinguish between abstract patentability and novelty they will find themselves lost in an inextricable sea of confusion ; the two points cannot be severed, therefore the only way is to look the matter fairly in the face and determine to organise such an examining body, whatever outlay it may entail, as shall shed lustre on the department by the thoroughness and conscientious character of its work.

2. We have been considering the question, What protection is the inventor to get ? The second question is, What is he to pay for it ?

With regard to this point it has been strongly urged on behalf of inventors that the patent fees should be still further reduced, as the Government are not warranted in imposing a tax on invention in order to augment the revenue, but should be satisfied with levying only such duties as will meet the current expenses of the Patent-office.

Now, in justice, we are bound to confess that those who advocate this side of the question have the best of the argument ; and we cannot but think that if it is intended to assimilate to the United States practice in the definition of *one invention* to which each application is to be limited, the fees also should be reduced to something like the figure charged in the States. This line of reasoning, it seems to us, is incontestable. If America can maintain a well-organised examining body and afford to grant patents at the almost nominal fees for which they are procurable in the States, surely we can do the same in this country, presuming, of course, that the applications here will equal in number those in the States. We trust, therefore, that the clauses of the Bill relating to the vexed question of fees will be carefully considered in committee with an honest desire on the part of the Government to grant such concessions as shall offer a stimulus to the inventive talent of the country. We are satisfied that such a course is most consistent with public policy, and, believing as we do in the justice and equity of encouraging inventors by giving them a substantial reward for their labours, it is with considerable confidence that we urge this point upon those who are intrusted with the settlement of this important question. T. J. HANDFORD.

ON PREJUDICIAL ACTIONS IN DYNAMO-ELECTRIC MACHINES.

ALL machines have injurious actions, which do not arise from faulty construction but are inherent in their nature, and which may be sometimes infinitely lessened but can never be suppressed altogether. In newly-invented machines, writes M. Frank Geraldy in *La Lumière Electrique,* "the defects are at first so numerous that the real nature and importance of the different causes of loss cannot be ascertained; the investigation of them can only be made later on.

"With dynamo-electric machines the period of uncertainty was somewhat short; their mechanical construction is so simple that any defect would be at once perceived and corrected, the imperfections existing could therefore only be electrical. This fact being quickly discovered, it is only lately that we have begun to make any progress in this question, and even now nothing can be stated with absolute certainty; nevertheless, I think that we may now, not perhaps estimate the importance, but at least distinguish the origin of different causes of electrical disturbances entailing losses of energy.

"It is customary to include them all under the common and vague designation of Foucault currents, signifying thereby currents closing on themselves in the interior of masses of metal, as was found to be the case in the experiment made by that electrician, in which a copper disc was made to turn between the poles of a powerful electro-magnet.

"We may here remark that it is not right to give the name of Foucault to these molecular currents, they had been observed before he drew attention to them. Faraday seems to have been the first to bring them to light; at any rate, Grove speaks of them explicitly in his remarkable work on 'The Correlation of Physical Forces,' and he even mentions an experiment analogous to that of Foucault, consisting of causing a magnet to turn before a bar or plate of iron. It will therefore be better to designate these actions, as I have already done, as molecular currents. This name answers the purpose without taking for granted a point which requires a little special study. It is quite true that the general cause of losses of electricity in machines is to be found in molecular currents, but we must distinguish between these currents.

"We must first separate the different conducting masses of the machine in which currents of this kind can be produced. Among these we should first mention the iron core, annular or cylindrical, according to the machines, on which are wound the wires of the induced part. We find in this core the currents of Foucault's experiment; in fact it is a metallic mass moving in a magnetic field, and according to the laws of induction currents must be developed in it, the direction of which shall be perpendicular to that of the motion. These currents are then directed according to the generators of the revolving body and parallel to its axis. They close upon themselves inside the body.

"We can also see in this core another cause of a current. Apropos of Foucault's experiment we may mention that of Le Roux. In the latter the arrangement is the same as in Foucault's experiment, a disc turning between the poles of an electro-magnet, but a rubber which is placed on the circumference and another near the centre, keep up a continuous current; these currents have therefore a radial direction in the disc. They arise from the fact that the speeds of the passage of different points of the disc into the magnetic field differ in proportion to their distance from the axis of rotation; the electromotive forces developed in them are therefore different, and the different points of a single radius are different in potential. The same effect is produced in the iron core of an induced coil, the interior of the ring is not at the same potential as the exterior. Does this difference produce internal currents? We cannot affirm that this is the case, but we have good reason for supposing so. The importance of the energy thus expended in heat in the cores varies very much according to their construction. M. Frolich, in a recent publication, gives very interesting details on this subject. He states in the first place that in the old Siemens machines with the bobbin containing a double T core, this core became heated considerably during the rotation. There is in them an action of the nature I have just indicated, but there is also something else; in these machines the currents of the bobbin are reversed alternately, and the core is therefore subjected to magnetic alternations which occasion, as we know, a loss of energy and a heating of the mass. In the Siemens machines with the bobbin in sections—for the cores trial has been made successively of a cylinder of soft iron, grooved cylinders, and cylinders formed of coiled wire—as the core is divided more and more, the quantity of work absorbed by the internal currents diminishes and falls from 15 to 3 per cent.

"It was in the Gramme machines, which were prior to those of Siemens, that this system of constructing the core, called the ring, of an insulated wire coiled in a close spiral was first employed. This was a considerable improvement to the machine; but nevertheless this precaution must not be pushed too far. In fact, in a core of this kind the insulating material replaces an equal volume of iron, and the magnetic mass therefore is so much lessened, which is an inconvenience; a certain mean must be adopted so that the insulator shall be sufficient without taking up too much space. Experience will show what is suited to different types of machines. It is not impossible for the cores to contain yet another cause of loss. In fact, we know that in the rotation the magnetic-poles remain fixed in the space, whereas the ring turns; there is therefore a continued displacement of magnetism in the substance of the core. This is evidently not equivalent to a series of magnetic reversals; nevertheless, we cannot positively affirm that this rotation of the poles takes place without any loss of energy.

"It is not merely the core of the induced part that is subjected to actions of this nature, the wires are also affected. Besides the inductive action in a direction perpendicular to the speed, the action which generates the effective current, the thickness of the layer of induced wire causes the outer and inner surfaces to pass with different speeds into the magnetic field, as we have already remarked concerning the core of the ring; they are therefore at different potentials, and this may give rise to internal currents. We can, nevertheless, understand that on account of the thickness of the layer being so slight in comparison to the size of the radius of rotation, this cause can only exercise a very feeble influence. A much more important cause of loss is to be found in the mode of construction of the induced part of the machines. This cause has been known for some time, and arises from the fact that the induced wire, although continuous, is subdivided into distinct parts. We know, in fact, that in a dynamo-electric machine the induced wire is wound in separate sections, the extremities of which are united on the metallic bars of the revolving collector, where the rubbing brushes receive the current engendered. The two extremities of one section touch two successive bars, and are thus disconnected; but during the rotation, when the bars come under the brush, a moment arrives when this rubber, passing from one bar to the other, is just over the two, then the two extremities of the section are connected by the metal of the rubber and this section is short-circuited on itself.

"If the ring contains an even number of sections, as is always the case, there will be two sections at once closed in this way upon themselves. This fact presents a double inconvenience: in the first place, the resistance of the circuit is suddenly and periodically changed; secondly, the sections thus closed are discharged upon themselves, developing an extra current by self-induction, not without loss of energy. It is true that this closing takes place at the moment when the sections pass into the neutral position, where the electro-motive force is nil, but they are nevertheless traversed by the current and consequently charged to a certain potential.

"This phenomenon has given rise to various explanations, which are open to criticism. I recently saw in a scientific journal the loss of force attributed to the reversing of the current in a wire when it passes from one pole to the other. 'Electric shocks and disturbances are produced,' the writer went on to say 'whence arises the loss of energy.' In reality nothing of the kind takes place; the change of direction of the current is effected by regular and successive stages, after a gradual annihilation of the electro-motive force; there are no disturbances or shocks. Besides the explanation I have given above is sufficient.

"This point has also given rise to various calculations also open to question. Thus a very eminent *savant* has recently proposed the following calculation:—Let l represent the coefficient of self-induction in one section, p the number of these sections, n the number of revolutions; the number of disturbing inductions per unit of time will be n, p, l—(I have already observed that two sections were closed simultaneously, it should therefore have been $2\ n, p, l$)—then $p\ l$ is equivalent to the co-efficient of self-induction of the whole ring, which we will call L, and n L will give the value of the energy expended. We see at once that if this theory were adopted the loss would be independent of the mode of subdivision of the induced part, and that it would be immaterial whether it were divided into 10, 50, or 100 sections. Now this is certainly incorrect. We imagine that 10 variations, each one-tenth of the total value, must be more injurious than 100 variations each one-hundredth of that value. Experiment fully confirms this opinion, and proves beyond a doubt that the more the induced rings are subdivided the better they are; our ideal would be a machine composed of an infinite number of infinitely small sections. This would evidently give perfect continuity, and the defect would disappear.

"We have therefore no known method of estimating this cause of loss. It is, besides, all the more difficult to calculate, as its action is not limited to the ring. The magnetic field is affected by these variations of the current produced, and the magnetic condition of the inductors must undergo from the reaction slight oscillations which do not occur without a certain loss of energy.

"What we can state confidently is that this disturbing element is less appreciable in large machines than in small ones, because the former allow of a much more considerable amount of subdivision than the others; therefore, as every one now acknowledges that large machines will hold the first place in the future, we have reason to hope that this inconvenience will continue to diminish.

"I have not pretended in this article to enumerate, even roughly, the disturbing influences existing in dynamo-electric machines. Notwithstanding the amount of study bestowed upon them during the last few years, they still have some surprises in reserve for us. I have only endeavoured to point out those among these influences that stand out from the rest and present themselves to our notice with some clearness. The subject becomes, besides, more and more interesting as the machines are more extensively used; it will become necessary to study it more attentively now that the grand application of the machines to the transmission of energy is about to be undertaken."

New American Companies.—The following new companies have lately been licensed, incorporated or organised: The McTighe Electric Light and Manufacturing Co., of Pittsburgh, Pa., capital, 300,000 dols.; the Garden City Electric Light Co., of Chicago, capital, 1,000,000 dols.; the Chicago Electric Light and Power Co., capital, 1,000,000 dols.; the Galesburg (Ill.) Edison Light Association, capital, 25,000 dols.; and the Indianapolis (Ind.) Parker Electric Light Co., capital, 100,000 dols.

LECTURES ON ELECTRICAL SCIENCE.

THE fifth of the series of six lectures on the Applications of Electricity was delivered on Thursday evening, the 19th of April, 1883, by Professor F. A. Abel, C.B., F.R.S., Hon. M. Inst. C.E., before the members of the Institution of Civil Engineers. The subject was "Electricity applied to Explosive Purposes." The following is an abstract of the lecture:—

In introducing the subject the lecturer indicated the principal advantages which it had been early observed would result from a certain mode of firing explosive charges by electric current instead of by the ordinary fuses, the best of which had inherent defects, greatly limiting their use for any but the simplest operations. He traced the history and development of electric firing from the crude experiments of Benjamin Franklin, about the year 1751, through the various stages in which frictional electricity, volta-induction apparatus, and magneto-electric machines had supplied the means of generating the current, the tendency of late years being to revert to a modified form of voltaic battery for one class of work and to employ dynamo-electric machines for another class. The history and development of the low-tension, or wire-fuse, and of the various fuses employed with electric currents of high-tension were also discussed, and their relative advantages, defects, and performances were described.

The only sources of electricity which at present thoroughly fulfilled the conditions essential in the exploding agent for submarine mines were constant voltaic batteries. They were simple of construction, comparatively inexpensive, required but little skill or labour in their production and repair, and very little attention to keep them in constant good working order for long periods, and their action might be made quite independent of any operation to be performed at the last moment.

When first arrangements were devised for the application of electricity in the naval service to the firing of guns and so-called outrigger-charges, the voltaic pile recommended itself for its simplicity, the readiness with which it could be put together and kept in order by sailors, and the considerable power presented and maintained by it for a number of hours. Different forms of piles were devised at Woolwich for boat and ship use, the latter being of sufficient power to fire heavy broadsides by branch circuits, and to continue in a serviceable condition for twenty-four hours, when they could be replaced by fresh batteries, which had in the meantime been cleaned and built up by sailors.

The Daniell and sand-batteries first used in conjunction with the high-tension fuse for submarine mining service were speedily replaced by a modification of the battery known as Walker's, which was after some time converted into a modified form of the Leclanché battery.

The importance of being able to ascertain by tests that the circuits leading to a mine, as well as the fuses introduced into that circuit, were in proper order very soon became manifest; and many instances were on record in the earlier days of submarine mining of the disappointing results attending the accidental disturbance of electric-firing arrangements, when proper means had not been known or provided for ascertaining whether the circuit was complete or for localising any defect when discovered.

The testing of the Abel fuse, in which the bridge or igniting and conducting composition was a mixture of the copper phosphide and sulphide with potassium chlorate, was easy of accomplishment (by means of feeble currents of high-tension), in proportion as the sulphide of copper predominated over the phosphide. Even the most sensitive might be thus tested with safety; but when the necessity for repeated testing, or even for the passing of a signal through the fuse, arose, as in a permanent system of submarine mines, the case was different, this fuse being susceptible of considerable alterations in conductivity on being frequently submitted to even very feeble test-currents, and its accidental ignition, by such comparatively powerful test or signal-currents as might have to be employed, became so far possible as to create an uncertainty which was most undesirable.

Hence, and also because the priming in these fuses was liable to some chemical change detrimental to its sensitiveness, unless thoroughly protected from access of moisture, another form of high-tension fuse specially adapted for submarine mining service was devised at Woolwich. This, though much less sensitive than the original Abel fuse, was sufficiently so for service requirements, while it presented great superiority over the latter in stability and uniformity of electric resistance; and, though not altogether unaffected by the long-continued transmission of test-currents through them, the efficiency of the fuse was not affected thereby.

Although high-tension fuses presented decided advantages in point of convenience and efficiency over the earlier form of platinum wire fuse, the requirements which arose in elaborating thoroughly efficient permanent systems of defence by submarine mines, and the demand for a battery for use in ships which would remain practically constant for long periods, caused a very careful consideration of the relative advantages of the high and low-tension systems of firing to result in favour of the employment of wire-fuses for these services. In addition to the disadvantages pointed out there was an element of uncertainty, or possible danger, in the employment of high-tension fuses which, though fully eliminated by the adoption of voltaic batteries in place of generators of high-tension electricity, might still occasionally constitute a source of danger, namely, the possibility of high-tension fuses being accidently exploded by currents induced in cables with which they were connected, during the occurrence of thunder storms or of less violent atmospheric electrical disturbances.

Experiment and the results obtained in military service operations had demonstrated that if insulated wires, immersed in water, buried in the earth, or even extended on the ground, were in sufficient proximity to one another, each cable being in circuit with a high-tension fuse and the earth, the explosion of any of the fuses by a charge from a Leyden jar, or from a dynamo-electric machine of considerable power, might be attended by the simultaneous ignition of fuses attached to adjacent cables, which were not connected with the source of electricity, but which become sufficiently charged by the inductive action of the transmitted current. It therefore appeared very possible that insulated cables extending to land or submarine mines, in which high-tension fuses were enclosed, might become charged inductively during violent atmospheric electrical disturbances to such an extent as to lead to the accidental explosion of mines with which they were connected. In a report by von Ebner on the defence of Venice, Pola, and Lissa, by submarine mines, in 1866, he refers to the accidental explosion of one of a group of sixteen mines during a heavy thunderstorm, as well as to the explosion of some mines by the direct charging of the cables through the firing station having been struck by lightning. Two instances of the accidental explosion of tension fuses by the direct charging of overhead wires during lightning discharges occurred in 1873 at Woolwich.

Subsequently an electric cable was laid out at Woolwich along the river bank below low-water mark, and a tension fuse was attached to one extremity, the other being buried. About eleven months afterwards the fuse was exploded by a charge induced in the conductor during a very heavy thunderstorm.

In consequence of such difficulties as these experienced in the special application of the high-tension fuses to submarine purposes, the production of comparatively sensitive low-tension fuses, of much greater uniformity of resistance than those employed in former years, was made the subject of an elaborate experimental investigation by the lecturer. Different samples of comparatively thin wires made from commercial platinum showed very great variations in electrical conductivity. Very considerable differences in the amount of forging to which the metal in the form of sponge had been subjected, did not importantly affect either its specific gravity or its conductivity, and the fused metal had only a very slightly higher degree of conductivity than the same metal forged from the sponge. The conductivity of very fine wires could therefore be but slightly affected by physical differences in the metal, and the considerable differences in conductivity observed in different samples of platinum were therefore chiefly ascribable to variations in the degree of its purity. It appeared likely that definite alloys might furnish more uniform results than commercial platinum; experiments were therefore made with fine wires of German silver, and of the alloy of 66 of silver with 33 of platinum employed by Matthiessen for the reproduction of B. A. standards of electrical resistance. Both were greatly superior to ordinary platinum in regard to the resistance opposed to the passage of a current. German silver was in its turn superior to the platinum-silver alloy, although the difference was only trifling in the small lengths of fine wire used in a fuse (0·25 inch), while the comparatively ready fusibility of the platinum-silver wire contributed, with other physical peculiarities of the two alloys, to reduce the fine German silver wire to about a level with it. Moreover, the latter did not resist the tendency to corrosive action exhibited by gunpowder, and other more readily explosive agents, which had to be placed in close contact with the wire-bridge in the construction of a fuse, while the platinum-silver was found to remain unaltered under corresponding conditions. Experiments having also been made with alloys of platinum with definite proportions of iridium, the metal with which it is chiefly associated, very fine wires of an alloy containing 10 per cent. of iridium were eventually selected as decidedly the best materials for the production of wire-fuses of comparatively high resistance and uniformity, this alloy being found decidedly superior in the latter respect as well as in point of strength (and therefore of manageableness in the state of very fine wire, 0·001 inch in diameter) to the platinum-silver wire. The fuses now used in military and submarine services were made with bridges of iridio-platinum wire containing 10 per cent. of the first-named metal.

The electrical gun-tubes in the navy were fired by means of a specially arranged Leclanché battery, and branch circuits worked to the different guns. In broadside firing it was important that the wire-bridge of any one of the gun-tubes which was first fired should be instantaneously fused on the passage of the current, so as to cut this branch out of circuit; in this respect the comparatively fusible platinum-silver alloy appeared to present an advantage, hence the naval electrical fuses were made with bridges of that alloy. Uniformity of electrical resistance had become a matter of such high importance in the delicate arrangements connected with the system of submarine mines, as now perfected, that the very greatest care was bestowed upon the manufacture of service electric fuses and detonators, which were in fact made in all their details with almost the precision bestowed upon delicate scientific instruments, and the successful production of which involved an attention to minutiæ which would surprise a superficial observer.

One of the earliest applications of electricity to the explosion of gunpowder was the firing of guns upon proof at Woolwich by means of a Grove battery and a gun-tube, which was fired by a platinum wire-bridge, a shunt arrangement being used for directing the current successively into the distinct circuits connected with the guns to be proved. When the high-tension fuse had been devised gun-tubes were made to which it was applied, and an exploder was arranged by Wheatstone having a large number of shunts, so that as many as twenty-four guns might be brought into connection with the instrument, and successively fired by the depression of separate keys connected with each.

The firing of cannon as time-signals was an ancient practice in garrison-towns, but the regulation of the time of firing the gun by electrical agency from a distance appears first to have been accomplished in Edinburgh, where, since 1861, the time-gun had been fired by a mechanical arrangement actuated by a clock, the time of which is controlled electrically by the mean-time clock at the Royal Observatory on Carlton Hill.

Shortly after the establishment of the Edinburgh time-gun others were introduced at Newcastle, Sunderland, Shields, Glasgow, and Greenock. The firing of the gun was arranged for in various ways; in some instances it was effected either direct from the observatory at Edinburgh, or from shorter distances, by means of Wheatstone's magneto-electric exploders. At present there were time-guns at West Hartlepool, Swansea, Tynemouth, Kendal, and Aldershot, which were fired electrically, either by currents direct from London or by local batteries which were thrown into circuit at the right moment by means of relays controlled from St. Martin's-le-Grand.

About thirteen years ago the electrical firing of guns, especially of broadsides, was first introduced into the navy with the employment of the Abel high-tension gun-tube and voltaic piles. The gun-tubes then used were manufactured simply for the proof of cannon and for experimental artillery operations, and were of very simple and cheap construction. Experience proved them to be unfitted to withstand exposure to the very various climatic influences which they had to encounter in her Majesty's ships and in store in different parts of the world. The low-tension gun-tubes, having a bridge of very fine platinum-silver wire surrounded by readily ignitable priming composition, was therefore adopted as much more suitable for our naval requirements.

The arrangements for broadsides or independent firing, and also for the firing of guns in turret-ships, had been very carefully and successfully elaborated in every detail, including the provision of a so-called drill or dummy electrical gun-tube which was used for practice and refitted by well-instructed sailors. The firing-keys and all other arrangements connected with the electrical gun-firing were specially designed to insure safety and efficiency at the right moment.

The electric detonators for firing outrigger torpedoes, or for other operations to be performed from open boats, corresponded, so far as the bridge was concerned, with the naval electric gun-tubes and were fired with a specially-fitted Leclanché battery. These electric appliances were now distributed throughout the navy, and the men were kept by instruction and periodical practice well versed in their use.

The application of electricity to the explosion of submarine mines, for purposes of defence and attack, received some attention from the Russians during the Crimean War, under the direction of Jacobi; thus a torpedo, arranged to be exploded electrically when coming into collision with a vessel, was discovered at Yeni-Kale during the Kertsch expedition in 1855. Some arrangements were made by the British, at the conclusion of the war, to apply electricity to the explosion of large powder charges for the removal of sunken ships, &c., in Sebastopol and Cronstadt Harbours. In 1859 a system of submarine mines, to be fired through the agency of electricity by operators on shore, was arranged by von Ebner for the defence of Venice, which, however, never came into practical operation. Early in 1860 Henley's large magneto-electric machine, with a supply of Abel fuses and stout india-rubber bags with fittings to resist water-pressure, were dispatched to China for use in the Peiho River, but no application appeared to have been made of them. The subject of the utilisation of electricity for the purposes of defence, however, did not receive systematic investigation in England or other countries until some years afterwards, when the great importance of submarine mines as engines of war was demonstrated by the number of ships destroyed and injured during the war in America.

The application of electricity to the explosion of submarine mines was very limited during that war, but arrangements for its extensive employment were far advanced in the hands of both the Federals and Confederates at the close of the war, men of very high qualifications, such as Captain Maury, Mr. N. J. Holmes, and Captain McEvoy having worked arduously and successfully at the subject.

The explosion of submerged powder-charges by mechanical contrivances, either of self-acting nature or to be set into action at desired periods, was accomplished as far back as 1583 during the siege of Antwerp, by the Duke of Parma, and from that period to 1854 mechanical devices of a more or less ingenious and practicable character had been from time to time applied to some small extent in different countries for the explosion of torpedoes. The Russians were the first to supply self-acting mechanical torpedoes with any prospect of success, and had the machines used for the defence of the Baltic been of larger size (they only contained 8 or 9 lb. of gunpowder), their presence would probably have proved very disastrous to some of the English ships which came into collision with and exploded them. Various mechanical devices for effecting the explosion of torpedoes by their collision with a ship were employed by the Americans, a few of which proved very effective. But although in point of simplicity and cost a system of defence by means of mechanical torpedoes possessed decided advantages over any extensive arrangements for exploding submarine mines by electric agency, their employment was attended by such considerable risk of accident to those at whose hands they received application, that, under many circumstances which were likely to occur, they became almost as great a source of danger to friend as to foe.

The most important advantages secured by the application of electricity as an exploding agent of submarine mines were as follows:—They might be placed in position with absolute safety to the operators, and rendered active or passive at any moment from the shore; the waters which they were employed to defend were therefore never closed to friendly vessels until immediately before the approach of an enemy; they could be fixed at any depth beneath the surface (while mechanical torpedoes must be situated directly or nearly in the path of a passing ship), and they might be removed with as much safety as attended their application.

There were two distinct systems of applying electricity to the explosion of submarine mines. The most simple was that in which the explosion was made dependent upon the completion of the electric circuit by operators stationed at one or more posts of observation on shore; such a system depended, however, for efficiency on the experience, harmonious action, and constant vigilance of the operators at the exploding—and observing—stations, and was, moreover, entirely useless at night and in any but clear weather.

The other, which might also be used in conjunction with the foregoing, was that of self-acting mines exploded either by collision with the ship, whereby circuit was completed through the inclosed fuse, or by the vessel striking a circuit closer, whereupon either the mine, moored at some depth beneath, was at once fired, or the necessary signal was given to the operator on shore.

Continental nations had followed in our footsteps in providing themselves with equipments for defensive purposes by submarine mines, and the Danes, Swedes, and Norwegians had pursued the subject of sub-marine mines with special activity and success.

In the United States the subject of the utilisation of electricity as an exploding agent for war purposes was being actively pursued, and important improvements in exploding instruments, electric fuses, and other appliances had been made by Smith, Farmer, Hill, Striedinger, and others already mentioned, while no individual had contributed more importantly to the development of the service of submarine explosions than General Abbot of the United States Engineers.

Illustrations of actual results capable of being produced in warfare by submarine operations had hitherto been very few; but of the moral effects of submarine mines there had already been abundant illustrations. In the war carried on for six years by the Empire of Brazil and the Republic of Uruguay and the Argentine Republic of Paraguay, the latter managed, by means of submarine mines, to keep at bay for the whole period the Brazilian fleet of fifteen ironclads and sixty other men-of-war. In the Russo-Turkish war submarine mines and torpedoes were a source of continued apprehension; and the French naval superiority was paralysed during the Franco-German war by the existence, or reputed existence, of mines in the Elbe.

The application of electricity to the explosion of military mines and to the demolition of works and buildings, had been of great importance in recent wars in expediting and facilitating the work of the military engineer. The rapidity with which guns, carriages, &c., were disabled and destroyed by a small party of men, who landed after the silencing of the forts at Alexandria, illustrated the advantages of electrical exploding arrangements, combined with the great facility afforded for rapid operations by the power possessed of developing the most violent action of gun-cotton, dynamite, &c., through the agency of a detonator.

The application of electricity to the explosion of mines for land defences during active war was not an easy operation, inasmuch as not only the preparation of the mines, but also the concealment of electric cables and all appliances from the enemy, entailed great difficulties, unless the necessary arrangements could have been made in ample time to prevent a knowledge of them reaching the enemy.

But few words need be said to recall to the minds of Civil Engineers the facilities which the employment of electricity to explosive purposes afforded for expediting the carrying out of many kinds of works in which they were immediately interested. Electrical blasting, especially in combination with rock-boring machines, had revolutionised the operation of tunnelling and driving of galleries; and, although in ordinary mining and quarrying operations the additional cost involved in the employment of fuses, conductors, and the exploding machine was not unfrequently a serious consideration, there were, even in those directions, many occasions when the power of firing a number of shots simultaneously was of great importance. There was little doubt, moreover, that accidents in mining and quarrying would be considerably reduced in number if electrical blasting were more frequently employed.

The conveniences presented by electric firing arrangements, under special circumstances, were interestingly illustrated by a novel proceeding at the launch of a large screw steamer at Kinghorn, in Scotland, which was recently accomplished by placing small charges of dynamite in the wedge-blocks along the sides of the keel and exploding them in pairs, hydraulic power being applied at the moment that the last wedge was shot away.

In the deepening of harbours and rivers and in the removal of natural or artificial submerged obstructions, the advantages of electric firing were so obvious that extended reference to them was unnecessary.

A substitute for electrical firing, which had been applied with success to the practically simultaneous firing of several charges, consisted of a simple modification of the Bickford fuse, which, instead of burning slowly, flashed rapidly into flame throughout its length, and hence had received the name of instantaneous fuse, or lightning fuse. The fuse burned at the rate of about 100 ft. per second; it had the general appearance of the ordinary mining fuse, but was distinguished from the latter by a coloured external coating. Numerous lengths of this fuse were readily coupled up together so as to form branches leading to different shot-holes, which might be ignited together so as to fire the holes almost simultaneously. In the navy this fuse was used as a means of firing small gun-cotton charges to be thrown by hand into boats when these engaged each other, the fuse being fired from the attacking boat by means of a small pistol, into the barrel of which the extremity was inserted.

The Vienna International Electrical Exhibition.—The Committee has just made an arrangement with the well-known publishing firm, A. Hartleben, of Vienna, to supply the exhibition with the literature of all countries respecting electrotechnics and electricity for the use of the visitors. The first cabinetmakers and decorators of Vienna have arranged to exhibit a row of magnificently fitted-up interiors, in order to show the enormous progress in decorating which will be compassed by employing the electric light.

THE CHAMBERLAIN GASLIGHT.

THERE is to be seen at 43, New Broad Street, E.C., a new gaslight, recently patented by Colonel Chamberlain.

It seems at present that there is but little chance of the electric light ousting ordinary coal gas illumination from the position it has occupied for so many years, but it may be that Colonel Chamberlain's process will accomplish to some extent that which electricity is doing but slowly. It is, however, scarcely within our province to speculate on that which is now produced on as minute a scale as were the first developments of lighting by electricity. As the matter stands Colonel Chamberlain not only shows the superiority of his new light over that of coal gas but he also manufactures his gas on a miniature scale at the address given above.

This process has been the subject of elaborate tests made by Mr. Henry Hutchinson, C.E., F.C.S., and we cannot do better than describe Colonel Chamberlain's invention in Mr. Hutchinson's words. This gentleman says that Colonel Chamberlain's process may be briefly stated to consist of decomposing petroleum oil and water (four parts petroleum and one of water) in a small iron retort heated to redness by means of coke, coal, wood, or gas. The gas as it issues from the retort contains no other impurity than a small amount of tar and carbonic acid gas, which are got rid of in passing through a small purifier containing water, where it is cooled, condensed in volume, and deposits its tar, thence proceeding into suitable gas-holders.

The gas is next diluted with three times its volume of "red hot" atmospheric air (but not cold air), and herein consists the greatest novelty of Colonel Chamberlain's invention, namely, the introduction of red hot air during the decomposition of the petroleum oil and the generation of the petroleum gas, in which condition the experimenter proved by numerous experiments the air must be admitted to the retort to bring about the necessary combination for producing a permanent and non-condensible illuminating gas.

In reference to the proportions of materials used, &c., he found, from a series of experiments, that by the use of 10 gallons of refined petroleum and two and a-half gallons of water, with the necessary quantity of "red hot air," 3,000 cubic feet of 18 to 20 candles gas, with a residual product of tar equal to half a gallon, could be relied upon. For comparison, and to show the great superiority of Colonel Chamberlain's gas, as compared with ordinary coal gas and water gas without petroleum, he shows their percentage compositions :—

COLONEL CHAMBERLAIN'S GAS.

Carbonic acid	= 2·1
Oxygen	= 10·0
Illuminating gases	= 21·4
Non-illuminating do.	= 20·5
Nitrogen	= 46·0
	100·0

COMPOSITION OF "COAL GAS."

Non-illuminating gases	= 93·25
Illuminating gases	= 6·46
Sulphur compounds	= 0·29
	100·00

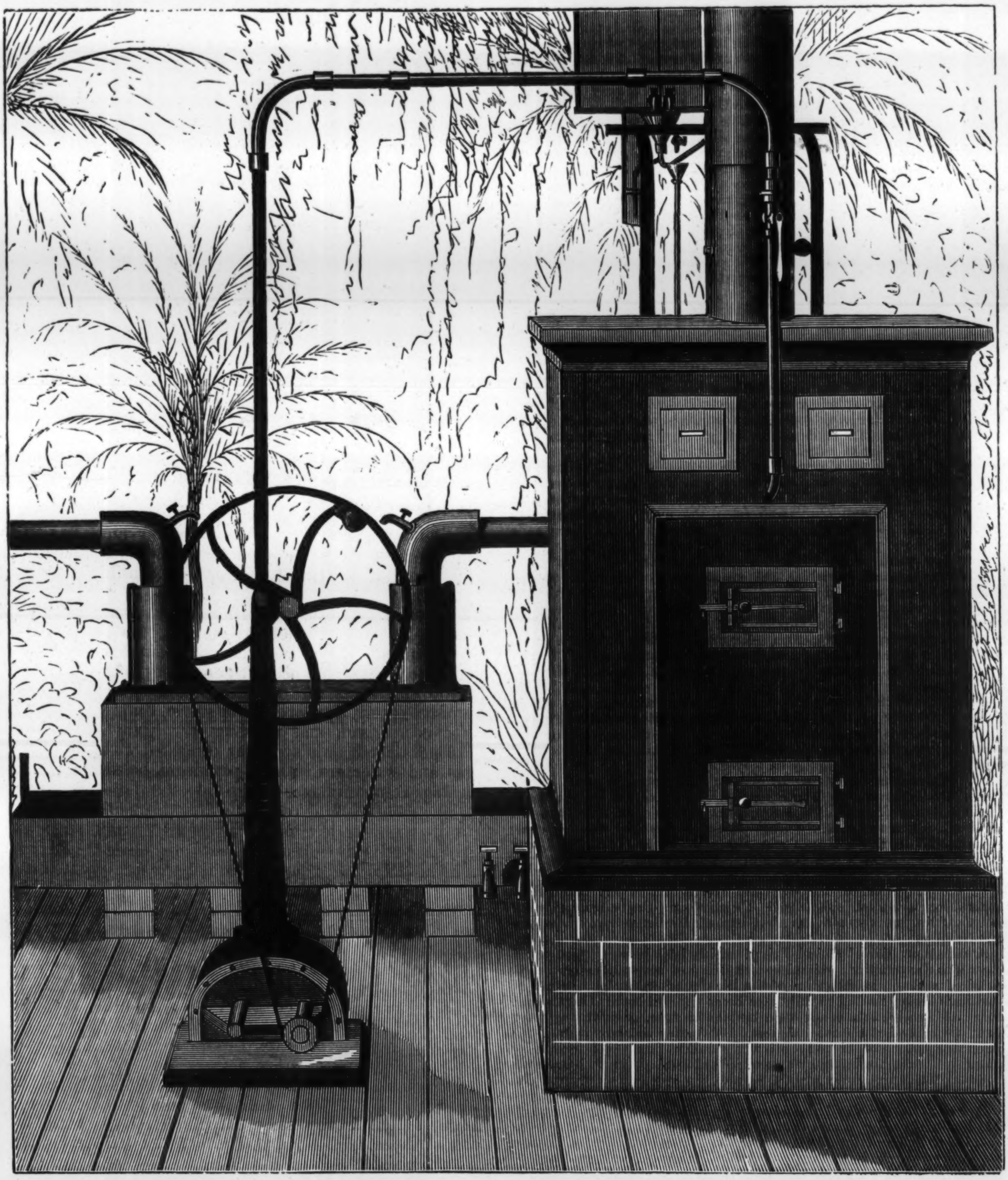
"WATER GAS WITHOUT PETROLEUM."

(Non-illuminating gases.)

Nitrogen	36.0
Hydrogen	25·0
Carbonic oxide	35·0
Carbonic acid	4·0
	100·0

"Thus," says Mr. Hutchinson, "we see in comparison with coal gas, whilst the latter only contains about 6½ per cent. of available light-giving gases, Colonel Chamberlain's petroleum gas, on the other hand, gives light-producing gas equal to 21½ per cent.; and even if Colonel Chamberlain's gas were sold to the public at the same price as ordinary coal gas, this petroleum gas shows, and also confers upon the public, a clear gain of light-giving power equal to 15 per cent., and by the use of the 'New Douglas' burner will give a light of very great and unusual brilliancy, superior to any yet exhibited or known to the public."

In reference to the cost of Colonel Chamberlain's gas, from the numerous experiments carried on, Mr. Hutchinson thinks he may safely say, taking into consideration the increased illuminating power per foot of gas, as compared with coal gas, and the small cost of production, purification, &c. (the latter a very costly and offensive process necessary in coal gas making), that from 10 gallons refined petroleum, with two and a half of water, gas of sufficient illuminating power is generated, when combined with red hot air, to give 3,000 cubic feet of 18 to 21 candle gas.



ESTIMATE OF COST OF 3,000 CUBIC FEET OF CHAMBERLAIN'S GAS.

Ten gallons petroleum oil, at 6d. per gal. ...	5s.
Water	—
Air	—
Coal and labour	6d.
Interest on capital, wear and tear	6d.
Total for 3,000 cubic feet	6s.

Equal to 2s. per 1,000 feet of gas, having an illuminating power of from 18 to 20 candles.

And deducting the value of the tar, which contains about half its weight of a valuable lubricating oil, as well as a small amount of brown colouring matter of great penetrating and staining power, with other valuable commercial properties, at 1s. 6d. per gallon only leaves 4s. 6d. as the actual cost of 3,000 feet of the petroleum gas, or 1s. 6d. for 1,000 cubic feet, which is a very small cost for a first-rate gas containing no impurities such as sulphur and sulphur compounds.

Another important advantage of Colonel Chamberlain's gas lies in the fact that 800 cubic feet of it will go as far as 1,000 cubic feet of ordinary coal gas.

Mr. Hutchinson concludes after three weeks' intimate acquaintance with the details of this process of manufacturing the patent petroleum gas, by asserting that the patent is a very valuable invention, of great public utility, simple in its manipulation and free from danger, giving a pure gas of great illuminating power, and will fulfil a public want long felt, more especially by the higher classes of society, where an independent and domestic method of manufacturing good illuminating and heating gas is required.

If we mistake not oil gases have been tried many times before, and therefore it would be premature to assert that Colonel Chamberlain's invention could be applied as successfully on a large scale for lighting districts as it is now for what might be termed home manufacture. That the gas will travel through long distances has yet to be proved, but, on the whole, the system appears to be highly promising. A general view of the apparatus for manufacturing the gas is shown in the drawing. The air is forced into the retort by means of a small "Roots" blower, seen on the left of the sketch.

AMPÈRE-METER

FOR ELECTRIC LIGHT INSTALLATIONS AND OTHER GENERAL PURPOSES.

(From the Design of HENRY F. JOEL, C.E.)

THERE is a daily and increasing necessity arising for current measurers of every description, and no installation of electric lighting, however small, can be carried on in a satisfactory manner without some means of observing constantly the amount of current that is flowing through the system. At the same time a most important desideratum consists in having an instrument, both simple in construction and of such strength and freedom from getting out of order, that it can be safely placed in the hands of an ordinary workman. The majority of instruments at present in use have several serious faults, in a commercial and rough practical view. One is that the price is almost prohibitory, and another that they are so delicately made that the slightest rough or careless usage renders them either completely useless, necessitating repairs, or the readings on the scale have a totally different value from that given to them. In one case a particular ampère-meter brought to our notice fell to half the reading in a few hours, thereby causing considerable error and annoyance.

The accompanying sketch (fig. 1) shows an ampère-meter designed to obviate in a great degree the foregoing defects. It is strong, simple, practically dead beat, and said to be very accurate up to a certain limit, and it is almost impossible to put it out of order.

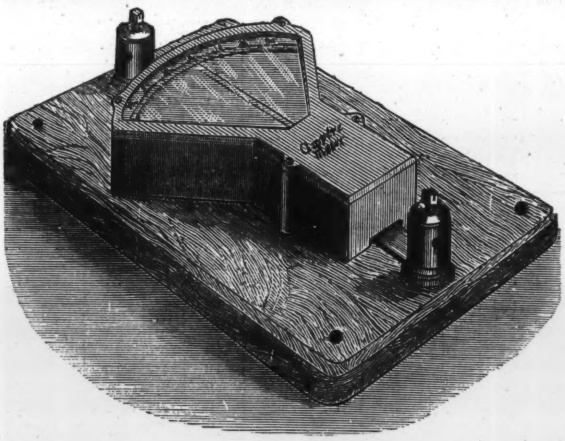


FIG. 1.

The instrument is constructed on the plan of an ordinary detector, but with this difference, that the wire beneath the needle is made of a broad copper strip of a width sufficient to embrace the whole of the magnetic needle to whatever angle it may turn. To one end of the needle is placed a pointer for taking scale readings, to the opposite end is attached a screw-threaded piece of brass wire with an adjustable weight; the advantage of this consists in the ease with which the instrument can be calibrated for any required reading (see details, figs. 2 and 3). The resistance of the copper is so small that no current can injure the arrangement. A looking-glass is placed under the scale to enable the eye to ascertain the perpendicular between pointer and needle, so that needle and scale shall coincide.

FIG. 2.

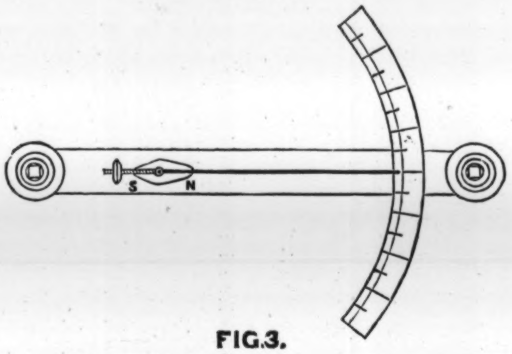
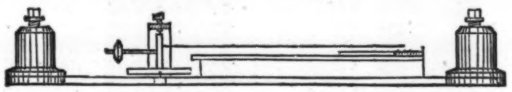


FIG. 3.



The instrument is arranged so that with a positive current entering from the bottom terminal the needle points to the right, and *vice versâ*.

For convenience of purchasers, the calibration of this ampère-meter is arranged in two ways. The scale readings can be obtained with the value of one ampère per degree, or adjustable for lower as well as higher currents.

The Albo-Carbon Light Company (Limited).—At the Crystal Palace Electrical Exhibition, which was closed last week, this company illuminated the Pompeian Court with its system, noted for the enrichment of ordinary coal gas, and the increase of its illuminating power. The light, which is much superior to the ordinary systems of gas lighting, particularly in respect to its steadiness and softness, is produced by the use of almost pure white carbon in a solid form, and requires no extraneous elaborate machinery, but accomplishes the same result of a highly improved illumination by a simple application to ordinary gas, which is thereby rendered brilliant and agreeable, and the cost of which is materially diminished. The invention consists, in the case of single lights, of a metallic vessel or chamber affixed at a little distance from the burner, and filled with the albo-carbon material through which, in a vaporised state, the gas passes to ignition. This material is inexplosive, safe, and portable, an excellent deodoriser and disinfectant, and the vessels containing it may be replenished almost indefinitely without the slightest accumulation or inconvenience. "One thousand cubic feet of common gas as ordinarily used will, by the albo-carbon appliance," it is said, "give fully as much illumination as 3,000 cubic feet without it, and the cost of the material to produce this result will not exceed 1s. 9d." Consequently the net cost of gas, with a superior illumination, is reduced about one half. Professor Keates, in a report upon the results of a series of experiments made to ascertain the photometrical and commercial value of the light, gives some interesting facts highly favourable to this new process; and Dr. Wallace, of Glasgow, reports that he has "made a series of careful observations in order to test the utility of the albo-carbon light, and has obtained very satisfactory results." Other tests have also proved highly complimentary to the invention, which is doubtless known to our readers.

ELECTRIC LIGHT LEADS.

IN our issue of January 6th, page 9, of the present vol. of the ELECTRICAL REVIEW, we published a paper by Mr. Sabine on electric light leads, containing two tables giving the H. P. consumed in the conductors of electric light leads with various currents from 5 to 1,000 ampères, and the approximate temperature to which the wires, supposed to be of bright copper, would be raised. The tables were constructed in French measures, and were therefore only of limited use to many English electricians. The following is a translation of the tables in question into English measures :—

I.—FOR CURRENTS FROM 5 TO 90 AMPÈRES, CONDUCTORS OF BRIGHT COPPER.

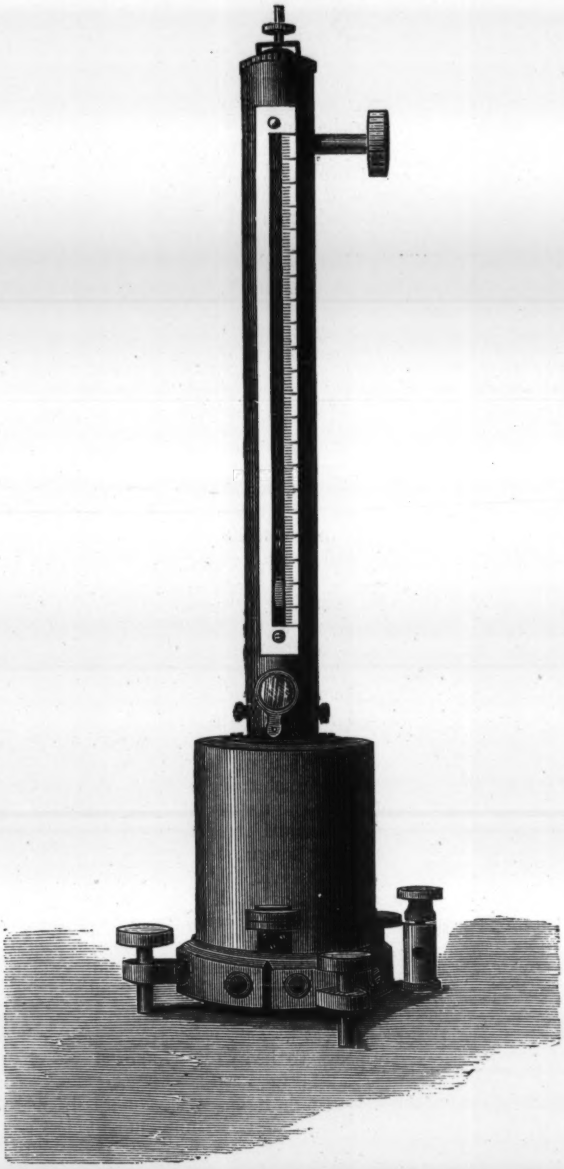
Diameter of Conductors.	5a		10a		20a		30a		40a		50a		60a		70a		80a		90a	
	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.
Inch.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.
·04	·89	38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·05	·49	19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·06	·36	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·07	·24	7	1·03	29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·08	·18	4	·76	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·09	·15	3	·55	12	2·4	49	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·1	·11	2	·45	9	1·9	36	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·11	·09	2	·36	7	1·5	27	...	...	...	...	...	...	...	...	...	...	...	...	...	...
·12	·076	1	·31	5	1·3	21	3·1	47	...	...	...	...	...	...	...	...	...	...	...	...
·13	...	...	·26	4	1·1	17	2·5	36	...	...	...	...	...	...	...	...	...	...	...	...
·14	...	...	·22	3	·91	13	2·0	29	3·9	51	...	...	...	...	...	...	...	...	...	...
·15	...	...	·19	2	·79	10	1·9	23	3·4	41	...	...	...	...	...	...	...	...	...	...
·2	...	...	·11	1	·45	5	1·0	11	1·9	18	3·0	31	4·4	41	...	...	...	...	...	...
·25	...	...	...	...	·26	2	·60	5	1·1	9	1·8	13	2·6	19	3·7	27	4·8	36	6·0	44
·3	...	...	...	...	·20	1	·44	3	·78	5	1·2	8	1·8	12	2·5	16	3·2	21	4·2	26
·35	...	...	...	...	·15	1	·33	2	·60	3	·92	5	1·3	7	1·8	10	2·5	13	3·0	17
·4	...	...	...	...	...	...	·24	1	·43	2	·67	4	·97	5	1·3	7	1·7	9	2·3	12
·45	...	...	...	...	...	...	·18	1	·34	2	·53	3	·72	4	·94	5	1·4	7	1·7	8
·5	...	...	...	...	...	...	...	...	·29	1	·45	2	·64	3	·88	4	1·1	5	1·4	6
·55	...	...	...	...	...	...	...	...	·24	1	·37	1	·53	2	·73	2	·95	3	1·2	4
·6	...	...	...	...	...	...	...	...	...	...	·28	1	·40	1	·54	2	·70	3	·90	3
·65	...	...	...	...	...	...	...	...	...	...	...	...	·36	1	·49	1	·64	2	·87	3
·7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	·45	1	·57	2	·72	2
·75	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	·62	2

Diameter of Conductor.	100a		200a		300a		400a		500a		600a		700a		800a		900a		1,000a	
	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.	Power absorbed per 1,000 yards.	Approximate rise of temperature.
Inch.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.	H. P.	Deg. Fah.
0·25	7·3	49	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·30	4·8	29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·35	3·4	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·40	2·8	13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·45	2·1	10	9·3	37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·50	1·8	8	7·7	29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·55	1·4	6	5·8	22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·60	1·2	4	4·9	16	11·8	40	...	...	...	...	...	...	...	...	...	...	..	...	...	...
0·65	1·0	3	4·2	14	9·8	28	...	...	...	...	...	...	...	...	...	...	...	...	...	...
0·70	·97	3	3·9	12	9·1	23	16·8	41	...	...	...	...	...	...	...	...	...	...	...	...
0·75	·78	2	3·1	9	7·3	18	13·3	32	21·9	50	...	...	...	...	...	...	...	...	...	...
1·00	·45	1	1·8	3	4·1	8	7·5	14	11·8	21	17·7	39	...	...	...	...	...	...	...	..
1·25	...	...	...	...	2·6	4	4·3	7	7·3	11	10·5	16	14·6	22	19·4	29	25·1	36	31·6	44
1·50	...	...	...	...	...	...	3·4	5	5·0	7	7·2	10	9·9	14	14·2	18	16·6	23	20·9	29
1·75	...	...	...	...	...	...	...	...	3·5	5	5·0	7	7·0	10	9·0	13	11·7	16	14·6	20
2·00	...	...	...	...	...	...	...	...	...	...	3·8	5	5·2	7	7·0	9	8·8	11	10·9	14
2·25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5·5	6	7·1	7	8·8	9

NOTE.—When the conductor is covered with india-rubber the rise of temperature will be about 25 per cent. less than the values indicated above.

New Atlantic Cable.—A New York paper says that the project for laying a submarine cable between Spain and Cuba is awaiting the resolution for its approval by the Minister of Public Works. The company which will own the cable has been constituted under the title of the Spanish-American (Ibero-Americano) Submarine Cable Company. It is proposed to lay the cable over a route that will be divided into three sections, the first of which will unite Portugal with the Azores, a distance of 1,000 miles; the second section to extend to the Bermudas, being 1,700 miles; while the third will terminate at Havana, a distance of 775 miles. The cable will be connected at the Bermudas with the City of New York by a cable of about 750 miles in length. From Havana a line about 380 miles long will be laid, connecting the cable with the Central American lines. The price fixed for messages between Spain and Havana is 1.50 pesetas, or 30 cents a word, the present rate by way of the United States being 1.20 dols. per word. The company petitions the Spanish Government to guarantee the annual transmission of 1,000,000 words.

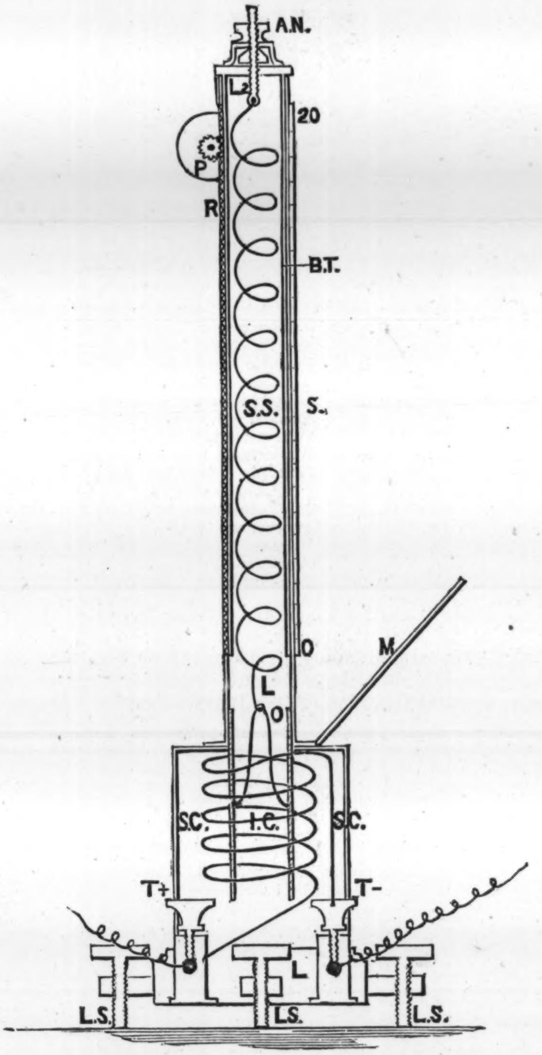
PROF. BLYTH'S SOLENOID GALVANOMETER OR AMPÈRE-METER.



AT the meeting of the Society of Telegraph Engineers and Electricians, on Thursday last, Principal Jamieson, of the College of Science and Arts, Glasgow, described a new form of current meter, which has lately been invented and patented by Prof. Blyth, of Anderson's College, Glasgow. The instrument, as shown at the meeting, will at once be understood by comparing diagram 1 with the following

INDEX OF PARTS.

When T + and T —		represent the (+) and (—) terminals to which wires from the battery or dynamo are attached. The current passes from T + to T — through
S C	,,	Solenoid coil, composed of No. 8 B. W. G. insulated copper wire (0·07 ohm resistance)
I C	,,	Iron core made of best soft iron, in the form of a thin tube; when current passes, I C is sucked down inside S C, against the resistance offered by
S S	,,	Spiral spring, which is attached to I C by loop (L^1), and at top to (L^2)
A N	,,	Adjusting screw at (L^2), for adjusting the zero.
R and P	,,	Rack and pinion, fixed to
B T	,,	Brass tube, which slides freely inside an outer brass tube. The inner brass tube carries a vernier, which by its position indicates on
S	,,	A finely divided scale (fixed to the outer brass tube), the current strength or number of ampères flowing through the solenoid coil (S C)
M	,,	Mirror, by looking down upon which the zero mark, O, on I C as well as the position of the vernier on the divided scale are seen simultaneously and parallax avoided.
L	,,	A spirit level.
L	,,	Three levelling screws.



To Take a Test with this Instrument

1st. Level it by means of the three screws, L S.

2nd. Free I C, and observe if the zero mark on the iron core and the zero of vernier and scale, S, agree; if not, adjust by screw, A N, and by R and P.

3rd. Attach to terminals, T + and T — the wires from battery, dynamo, or other source of electricity. Immediately the current passes through the solenoid coil, S C, the iron core, I C, is sucked down proportionally to the strength of current passing.

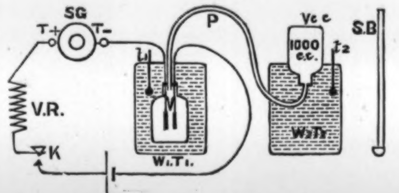
4th. Raise the iron core, I C, by means of the rack and pinion, R P, until the zero mark on the iron core again appears at its zero position.

5th. Read the position of the vernier on scale, S, which may be divided into ampères or millimetres. If into millimetres, then look in attached table for the corresponding ampères.

One of the great advantages which will recommend itself to every practical electrician, and which was very clearly pointed out by Prof. Jamieson, is that it is unaffected by either the earth's magnetism or proximity of iron or magnets. It has the further advantage of not depending in any way upon so-called permanent magnets, which we know to our cost are not permanent.

Its range and sensibility are very great, the instrument shown indicating from ·1 ampère to 24 ampères to the second decimal place, and by the addition of two additional solenoid coils it can be made serviceable up to 100 ampères.

Prof. Blyth has also made provision for making potential or electromotive force galvanometers on the same principle.



The instrument has been graduated by the electrolysis of water, which is believed to be the most correct method (see diagram 2).

PLAN OF CONNECTIONS USED IN GRADUATING.

When	B	represents	Battery or current generator.
	K	,,	Key for closing circuit.
	V R	,,	Variable resistance coil for adjusting current strength.
	T + and T —	,,	+ and — terminals of
	S G	,,	Solenoid galvanometer.
	V	,,	Voltameter placed in
	W_1 T_1	,,	Water tank, kept at one temperature.
	P	,,	Bent pipe for conducting mixed gases (H_2 and O) over to
	C C V	,,	Cubic centimeter vessel say 250 or 1,000.
	W_2 T_2	,,	Another water tank, kept at one temperature.
	t_1 t_2	,,	Centigrade thermometers.
	S B	,,	Standard barometer.

The mixed gases are collected by displacement in (C C V) a vessel of known capacity. The time to fill the vessel being very carefully noted by a stop watch, the temperature observed, as well as the barometer in millimetres, we have at once, by a combination of Gay Lussac's and Boyle's laws—

$$C = \frac{V \times 273 \times P}{0{\cdot}1764 \times t\,(273 + \theta) \times 760}$$

Where C = Current in ampères,
V = Volume of gas given off in C C.
P = Height of barometer.
t = Time in seconds.
θ = Temperature cent.
0·1764 = Volume of mixed gas (H_2 and O) given off per second by 1 ampère.
273 = Constant for variation of volume of a gas with temperature.
760 = Standard barometric pressure.

We shall be glad to hear of actual practical working tests with this instrument, which registers alternating as well as continuous currents, as we are somewhat curious to know whether the spring opposing the pulling force of the solenoid is to be depended upon.

Cable Manufacturing.—At the recent meeting of the Maxim-Weston Electric Light Company, which was reported very fully in the last number of the ELECTRICAL REVIEW, the Chairman said: "Their cables had to be laid two or three times. The contractors who made them did not prove equal to the task they were required to perform, and their great losses in the City lighting had been owing to these cables." What do our leading cable manufacturers think of this statement? We should be much rather inclined to think that the fault was due to those who ordered the cable, and who probably did not know what to specify, the result being that three cables at least were made before satisfactory working could be obtained. At any rate, the Chairman of the Maxim-Weston Electric Light Company ought to know—and we take the opportunity of bringing it before his notice—that our cable manufacturers *can* produce any *specified* cable, but they are not supposed to make experiments for the benefit of electric lighting companies which do not know their own requirements.

REVIEWS.

Electrical Lighting Arrangements, with Especial Reference to their Practical Execution. By Dr. ALFRED VON URBANITZKY. Vienna, Pesth, Leipzig: A. Hartleben.*

THIS treatise, the eleventh volume of the *Elektrotechnischen Bibliothek*, must be regarded as a supplement to the work on the electric light (vol. iii. of the same series), already noticed in the ELECTRICAL REVIEW. The object of the former volume was to describe the various machines, lamps, &c., necessary for the production of the electric light. In the present treatise the author discusses the entire arrangements for lighting up towns, industrial establishments, theatres, &c., commencing with the motive power.

The author points out that the introduction of the electric light is a somewhat complicated undertaking, which requires a careful consideration of the spaces or objects to be illuminated, as well as the selection of suitable machines and lamps and the due supply of motive power. The intensity of the electric light so far exceeds that obtained from gas, from candles, or from petroleum, that the experience gained from the use of the latter is here no guide. It is a mistake to say "If one electric light equals ten gas-burners all we have to do is to place one of the former instead of ten of the latter." The question arises where the new lights must be introduced so as to be of the greatest service, and to this no general reply can be given.

The points to be especially regarded in the motive power, whether obtained from gas or steam-engines, turbines, &c., are extreme regularity of movement and sensitive regulation. Irregular moving powers can only be used indirectly, that is, with the intervention of accumulators. Here the author warns his readers against a common error. We sometimes hear it said that in some particular case the electric light will cost nothing beyond the first outlay and the consumption of carbons, as the machines may be driven by the spare power of a steam-engine or a water-wheel already at work on the premises. But a steam-engine, driving heavy machinery, in which force is of more importance than absolute regularity, is very ill-suited for propelling a light-machine. The quantity of power which such a steam-engine is called upon to furnish is not always constant; in dye, print, and chemical works it varies from hour to hour, according to the nature of the work in hand. Hence it would produce serious irregularities in the movements of the dynamo or magneto-electric machine used for the production of the electric current.

Single-action steam-engines and those with only one cylinder the author considers unsuitable, as their two dead-points cause irregularities which are escaped in double-cylinder engines. Hence he recommends the use of the regulator constructed by Koch, of London, and Durham, of New Barnet, a description and figure of which, taken from the *Elektrotechnische Zeitschrift*, are appended. Dr. Spottiswoode appears to have experimented with this apparatus and to have obtained satisfactory results. The regulator was applied to a horizontal engine of 12 horse-power which impelled a De Méritens' dynamo machine supplying 14 arc-lights and four circuits with 30 Swan lamps. Four arc lights and 30 glow lights were started and the latter were suddenly extinguished without affecting the rotations of the dynamo machine.

Dr. Von Urbanitzky, however, remarks that, even with the best double-cylinder engines, fitted with the best regulators, the rotation of the dynamo is still liable to irregularity or even to interruption, owing to the connection of the two by means of belt and drum. If the belting does not grip, the number of rotations is affected and if it slips off or breaks, the machine is stopped and the light is extinguished. Hence he recommends the so-called rotary engines of Brotherhood, Dolgoroucki, Maxim, &c. Here the axle of the light-machine is directly connected with that of the engine. These machines take up relatively little space, but their consumption of steam is somewhat great; for private houses he recommends the Otto gas-engine.

The weight which the author lays upon the selection and

Die Elektrishen Beleuchtungs-Anlagen mit besonderer Berücksichtigung ihrer Praktischen Ausführung.

regulation of the motive power will not appear excessive in view of the fact that the fluctuation or temporary extinction of the light is one of the gravest objections urged by the public against electric lighting.

As regards the light machines themselves, it is remarked that from a mechanical point of view, solidity and permanence are the main considerations. "The principle of construction varies but little, the differences being often mere evasions of existing patents, not always improvements and often quite unmeaning."

The regulation of the strength of the current is explained to be equally important for lamps and machines. A sudden decrease in the resistance, such as ensues on the extinction of one or more lamps, augments proportionately the strength of the current, increases the intensity of the remaining lamps, and may become very injurious to the insulation in the light machine, and in the lamps themselves. Any increase in the resistance, such as the insertion of more lamps, has the opposite effect. Hence, to insure a constant light, regulation of the current is as essential as that of the motive power. To obviate this inconvenience, a number of devices have been proposed and are here described, such as those of Brush, Deprez, Avenarius, Napoli, Latchinoff, Westinghouse, Maxim, Lane-Fox, Edison, Siemens, Hospitalier, and Gravier. In concluding this section, the author remarks that accumulators when perfected will prove excellent regulators, as by introducing them into the circuit the lamps can be rendered perfectly independent of the machine.

For the insulation of the conductors we find mention of the proposal of Geoffroy, who encloses the copper wires with asbestos, pressed down by a lead tube. Asbestos is not merely a good insulator, but conducts heat so badly that even if the copper wires are fused the outer casing of lead remains undamaged. The author quotes the conclusions of a commission at Philadelphia which examined this subject, in view of the prevention of fire. Among these it is proposed that regular inspection should take place at certain intervals, to ascertain if the insulation has been damaged by perforation by the hooks supporting the wires, by sharp bends, or by abrasion. The composition of the conducting wires of numerous short pieces should be avoided, and if inevitable, the junction should be as far as possible secured by wrappings to prevent the ends of the wires separating and giving rise to small arcs, or to sparks. The wires should not be brought in close proximity to metallic objects, and especially to gas or water-piping. The possibility of short-circuiting should be guarded against by keeping the wires from different machines, or from different parts of the same machine, as far as possible from each other. The wires which convey the current into the space to be illuminated should have their exit in a distant part, and should be allowed to hang down loosely only in cases where it is necessary for raising or lowering the lamps. The conductors should be carried along the ceiling in preference to the partition walls or the flooring. It might be said that all these regulations are a matter of course, which every electrician would endorse, and which, therefore, need no repetition. But it sometimes happens that in practice matters of course are strangely overlooked.

The following chapters deal with the measurement and registration of the electricity supplied—a matter of some moment if the current for lamps has to be sent from central stations to numbers of consumers—and special conductors and methods of introduction. Chapter vii. treats of lamps and their adaptation to different localities; the number to be employed; their height of suspension and arrangement, points for which no universal rules can be given.

As regards the measurement of the intensity of light the author observes that the standard carcel of France, burning colza oil and the standard candles of England and Germany, made respectively of spermaceti and paraffine, can lay no claim to accuracy and constancy. The material burnt is not a definite chemical compound, and a variety of circumstances may prevent the results obtained from being strictly comparable. It must further be remembered that the flames of candles, oil, gas, &c., send out their most intense rays horizontally. On the other hand, in electric regulator lamps, the positive electrode sends out the larger proportion of light rays at an angle of about 60° with the horizon, whilst electric candles emit the greatest light in a line perpendicular to the line connecting the carbon points; glow lights with imperfect conductibility give also most light in the direction perpendicular to the plane of the carbon loop. It is evident, therefore, that if an electric lamp and the normal candle are measured in one and the same horizontal plane the result must be entirely erroneous. Various means of overcoming or evading this difficulty are suggested.

The ninth chapter of the work is devoted to a comparison of the electric light with gas-lighting, in which the respective advantages and drawbacks of the two systems are very fairly stated. The electric light, as compared with sun-light, is somewhat deficient in the middle regions of the spectrum, the green and the blue, whilst it is relatively more powerful at the two extremities, the red and the violet, the violet preponderating with currents of very high tension. An advantage of the electric light, first, apparently, pointed out by the eminent oculist, Dr. Happe, is that if the acuteness of vision by daylight = 1, by gaslight it sinks to 0·5 — 0·7, but by the electric light rises to 1·2 — 1·5. The deleterious character both of coal-gas itself and of its products of combustion, is a well-known but neglected fact. A contamination of air with 2 to 3 per cent. of coal-gas proves fatal if inhaled for any length of time. The only advantage of gas—supposing that the two lights can be produced at about an equal cost—is its ready divisibility.

The remainder of the work is devoted to an account of electric illumination as already applied, on a practical scale, in light-houses, docks, manufactories, theatres, &c. The impression left on the mind of the reader is that the electric lamp in some of its various forms must be recognised as the light of the future. Gas, however, will always retain a place as a source of heat in the work-shop, the laboratory, and the kitchen, but from our libraries, our museums, our drawing-rooms, theatres, and sale-shops it must submit to be banished.

PROCEEDINGS OF SOCIETIES.

Physical Society.—April 14.

Prof. G. CAREY FOSTER in the chair.

New Members—Mr. W. F. Smith, Mr. George Forbes, M.A.

Mr. W. LANT CARPENTER read a paper on "Science Demonstration in Board Schools," in which he showed the drawbacks of the present system of leaving science to be taught by the other masters, and pointed out the marked advantages of the system followed in Birmingham and Liverpool, where skilled lecturers are appointed to go from school to school and provided with an assistant demonstrator and proper apparatus. Mr. CARPENTER advocated the extension of this system to London and the country in general. He also showed the evil of the present system of cramming for examinations. Dr. W. CARPENTER pointed out the advantages of object lessons in training the minds of children. Dr. J. H. GLADSTONE stated that much had been done in London to introduce object lessons, and that under the Mundella code science would be taught in all Board Schools to all the children, who however might have the opportunity of choosing between science and literature. Mr. W. BAILY, Prof. FOSTER, and Prof. W. CHANDLER ROBERTS also advocated the system of special science teachers.

Prof. ROBERTS then took the chair, and Mr. GLAZEBROOK explained a new polarising prism which he had devised to prevent displacement of the pencil of rays. He also showed how the curved diffraction gratings of Prof. Rowland do not always give perfect definition; and calculated the aberration of the rays. The Secretary then read a paper by Mr. W. H. STOKES and Mr. A. E. WILSON on "Experiments on the Viscosity of Saponine." When a disc is rotated in water the resistance to its motion is greatest when the plate is immersed a little below the surface; but with saponine the viscosity is greatest when the disc is not wholly but only partially immersed below the surface.

April 28th.

Prof. Clifton in the chair.

A paper on "Colour Sensation," by Mr. H. R. Troop, was read by Mr. Walter Baily, secretary. The author showed that more than three colour sensations were consistent with the theories of Maxwell and Helmholtz, and explained that four primary separate colour sensations, in couples, served the theory as well as three. The author gave reasons for the existence of a fifth sensation—that of white. Mr. Stanley mentioned that his father was colour-blind to green, and saw it as a brown. He considered partial colour-blindness very common. Mr. Lewis Wright stated that he found in optical experiments a partial colour-blindness from time to time, and between one of his eyes and the other. He recommended the study of this partial and variable blindness to colours. Prof. Clifton stated that he had found similar variations amongst his students, and considered that one in three were unfit for delicate optical experiments.

Sir John Conroy exhibited a new photometer, which is a modification of Ritchie's, the white screens not meeting at an angle, but almost meeting, and one projecting a little beyond the other, so that the eye could see the outer side of one and a little of the inner side of the other, both visible surfaces being illuminated by the lights. The screens were enclosed in a blackened box.

Mr. Walter Browne then read a paper on the "Causes and Consequences of Glacier Motion." After reviewing the various theories of glacier motion, and criticising each, the author gave reasons for preferring that of Mr. Moseley, namely, expansion by heat. He showed that the regelation theory, now commonly accepted, appears inadequate, inasmuch as it does not explain the state of flow at low temperatures.

Mr. Stanley pointed out that Forbes, in his work on Norway, gives expansion as a cause of glacier motion.

Professor Perry referred to the experiment of Mr. Bottomley (in which a wire, weighted at the ends, cuts its way through a block of ice) in support of the regelation theory, and Professor Guthrie described an experiment he had made of the same kind, using a copper wire and a silk cord of the same thickness equally weighted, on the same block of ice. The wire cut through, but the silk did not.

Professor Ayrton explained this on the assumption that the wire conveyed heat from the air, and enabled the weighted wire to lower the temperature of the ice to the melting point, whereas the silk could not do so without more pressure, that is, weight.

Mr. W. Coffin referred to the ice-houses of Lake Superior, where he has seen heavy iron implements lying on blocks of ice at a low temperature without sinking in. Sinking took place when the sun shone on the ice.

Professor G. Forbes said that below 40 feet in rock variations of temperature were imperceptible, and probably it was the same with ice.

Professor Macleod, Mr. G. R. Griffiths, Mr. W. Baily, and the President also took part in the discussion.

Professor Fuller then took the chair, and Professor Clifton exhibited a new spectrometer of his design. In the spectrometer it is important that the axis round which the prism turns, and the axis round which the telescope turns, should not be inclined, and in the new instrument these axes are coincident. A single cone, turned very true, has the telescope piece, the circle, and prism plate fixed upon it.

The Society of Telegraph Engineers and of Electricians.

An ordinary general meeting of this society was held on Thursday, April 26th, Mr. Willoughby Smith, president, in the chair.

The minutes of the last ordinary general meeting having been read and confirmed, and the list of new and proposed new members read, the adjourned discussion on the papers read at the previous meeting was continued.

The Secretary read a letter received from Professor Silvanus P. Thompson. Professor Thompson said he did not agree that variations of contact between conducting surfaces were discovered by Le Comte du Moncel or by Clerac, since the difficulty of getting a good contact in battery terminal screws had long been known. As the results of microphonic investigations, two distinct points presented themselves, viz., the range through which the action took place, and the change of resistance resulting from the action. In metals the range of distance was much less than in the case of carbon, a change of resistance from almost zero to 1,000 ohms or more taking place from a very small movement. Bad conductor contacts cannot be brought down to so low a value as is the case with good conductors, but on the other hand, bad conductors have a greater range of distance than good conductors. Manganese has a greater range of resistance than carbon. Bismuth has an extremely small range, and therefore could not answer at all well for a microphonic transmitter. As the result of some experiments made by Mr. G. S. Anders and himself, it was found that *clean* metal contacts worked better than carbon, the difficulty, however, was to render the extremely small possible range of distance available. Silver, very highly polished, gives very good results. The effect he considered to be due to the number of molecules of metal brought into contact by the different pressures; if this is the case, the better the conductor the better would be the effect if other considerations did not come into play to modify the result. As a matter of fact, better results could be obtained from silver than from carbon. Messrs. Theiler have for some time used a metal for the purposes of a transmitter, and therefore Messrs. Munro and Warwick cannot claim to be the first in this respect. Blake also mentions the possibility of using metal alone. In conclusion, Professor Thompson argued that Reis was the first person who had invented and used a microphonic transmitter.

Professor Hughes said that there were two points to be considered in the microphone, viz., the mechanical and the electrical. Ochorowitz's experiments, described in the Electrical Review for November 1st, December 15th, 1879, and January 1st, 1880, were very complete, as in them both the mechanical and electrical aspects of the question were considered. It was found in the experiments that a diaphragm was *not* necessary, by *using* a diaphragm. Professor Hughes then stated that he had experimented with a microphone completely embedded in sealing-wax; he found that when the carbons were held so as not to be in contact the microphone would not act, but when the wax was melted, so that the contacts could come together, then the microphonic action was good, and it remained good even after the wax had set hard. He considered Mr. Bidwell's paper was full of anomalies. Two electrodes in contact will always give an arc when separated, no matter whether the battery power was high or low; it was merely a question of degree. He therefore considered the arc theory of the microphone perfectly feasible. Ader's microphone, in which an actual arc was employed, would speak perfectly though the arc sounds somewhat spoiled the effect.

Prof. Ayrton thought that the expression microphonic "contact" was incorrect, it should be microphonic "separation." Experiments made with metals showed that the "striking" distance of a spark between them was less than in the case of carbon; this accounted for Prof. Thompson's results as regards the range of microphonic contacts. He considered that the action of the microphone was partly due to electrodynamic repulsions.

Mr. J. Munro thought that it was a silent discharge and not an arc that took place at a microphone contact. Two conducting points with a discharge between them were the essentials of a microphone; but attraction and repulsion also enter into the question. Mr. Munro exhibited a microphone in a vacuum tube, which he stated acted well; its action could be adjusted by an external magnet.

Mr. A. Jamieson then gave a description of a new solenoid galvanometer (see p. 373); and Mr. Moon exhibited a static induction telephone, in which the static attraction between the metallic paper surfaces are made use of to obtain musical and other sounds, somewhat on the principle of the Edison electromotograph telephone receiver.

The meeting then adjourned.

Electrical Railways in Vienna.—The firm of Messrs. Siemens and Halske have applied to the Austrian Government for permission to undertake preparatory works requisite for the construction of electrical railways in Vienna.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Letters, &c., for the "Correspondence" columns should arrive not later than Tuesday morning if they are desired to appear in the following number, such communications to be addressed to the "Editors," ELECTRICAL REVIEW, 22, Paternoster Row, London, E.C.

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CORRESPONDENCE.

Dynamo-Electric Machine Patents.

I am constantly hearing and reading about dynamo-electric machines, by various makers, which have armatures or bobbins described as "of the Gramme" or "of the Paccinotti" type. I understand this to mean a bobbin in which the insulated wires are wound transversely, or parallel to the axis of the bobbin, but around the rim of the ring, utilising the inner and outer surfaces of the ring, which is supposed to be of iron. If this is a Paccinotti bobbin why is it called a Gramme? If a Gramme why called a Paccinotti? I understand that Gramme has a patent in which claim is made for certain peculiarities in the structure of the bobbin, and yet I am told that no one can construct a Gramme bobbin if the specifications in Gramme's patent are taken for a guide. Again, I am informed that Paccinotti constructed a dynamo, and obtained a patent for the same, in every respect similar to that on which Gramme afterwards obtained his patent. Can you inform me as to the true condition of these matters? If Paccinotti did invent such a bobbin, how can the Gramme have any value? If the Gramme patent has any standing in this country, why have the owners of it allowed so many years (thirteen, I believe) to elapse without prosecuting for infringement? for to-day there are but few dynamo machines in which bobbins of the so-called "Gramme" or "Paccinotti" type are not used. I noticed in a recent issue of the Review a note referring to a legal proceeding of the British Electric Light Company *v.* the Anglo-Brush and the Electric Power Company. Does this refer in any way to the Gramme patent? for I believe the former company claims to own the Gramme patent.

Gramme's first (or about the first) machine had a core composed of iron *wire*, and I believe to this day the core is still constructed in the same manner. How, then, can a bobbin in which the core is formed of discs or rings of iron or bars of iron be said to clash with Gramme's patent, when Gramme's patent is drawn up so that one cannot construct an armature from his specification?

Pardon me for trespassing upon your time and space, but as I am but one of a number who desire light thrown upon this subject, I have taken the liberty.

Inquirer.

London, *April 25th*, 1883.

[We would rather leave our correspondent's queries to be answered by some of our readers, several of whom are, no doubt, well acquainted with the subject matter of "Inquirer's" letter.—EDS. ELEC. REV.]

The Telephone.

The instructive and impartial letter of "Common Sense," in your issue of 21st April, refers to my transmitters in patent 3,008, 1882, as "a combination of diaphragm and tension-regulator." If the legal definition of the Edison claim is "any substance which separated the tension-regulator from the air waves, either before or behind the tension-regulator," constitutes a diaphragm, permit me to refer him to figs. 6, 6A, and 8 of this patent, in which the tension-regulator separates the electrodes, and is neither "before or behind," but between the two. Under these circumstances it would be interesting to have a "Common Sense" opinion as to how my electrodes are transformed into a diaphragm and made to appear as within the Edison claim.

José D. Husbands.

April 25th, 1883.

Long-Distance Telephoning.

The subject of long-distance telephony has been occupying the minds of many persons lately, receiving a fillip every now and again by the positive statements of our American friends. Details, however, appear to be wanting in most of the experiments referred to. In the year 1881, I was enabled to test some distances for telephonic speaking by means of the ordinary Bell and Blake and Gower-Bell instruments, and I found that when using a single wire underground wires were not favourable. Thus, between Middlesbrough and Stockton, barely three miles, one and a quarter of which was underground, the speaking was most feeble and difficult. To Hartlepool, with a small submarine cable across the Tees, a length of underground wire, and a total distance of some ten miles, speech was good and clear, whilst between Middlesbrough and Whitby, with about three-quarters of a mile of underground, conversation was very fair, induction slight. On removing the earth at the Whitby test box, however, and extending the wire to Hull, the induction was at once so overpowering that nothing whatever could be heard. From these and a variety of other experiments made over postal wires, it would appear that what is wanted for long-distance telephoning with single wires is an instrument which, whilst it shall ignore or not be affected by induction, shall also be made to respond by proportionate battery-power. The resistance of the circuit would, of course, have a prominent part to play in the matter. By the prospectus of the Long-Distance Telephone Company, I see they propose erecting wires of No. 2 size and to form a metallic circuit. That of course will vastly reduce resistances as compared with those used successfully for telegraphic purposes. At any rate, the matter is apparently about being tested in a practical shape by parties who appear to have sufficient faith in it to put good money into it.

Bertie.

Working by the Electric Light.

In this evening's *Globe* there is a letter entitled "The Block in the Strand," complaining that the workmen only do ten hours a day.

There would be no difficulty in working advantageously twenty-four hours if arc lamps were used for illumination.

A. J. F.

May 1st, 1883.

Electrical Testing.

In the ELECTRICAL REVIEW for March 10th, Mr. J. J. Fahie kindly replied to my question as to how E.M.F. could be measured upon the metre bridge. I have tried the method given in fig. 1, and in the words below it, and I regret to say that I could not make it work. The galvanometer could not be brought to zero. I fear there is a mistake somewhere.

Permit me to ask Mr. Fahie if he has actually measured the E.M.F. of a cell or a series of cells by the arrangement he describes. If so, I would further ask that he favour me with a numerical example of his work.

The modification of the test, as given by fig. 2, I tried successfully. It seems to be not only an easy and rapid but also an accurate method of ascertaining electromotive force and internal resistance at one operation. I would be glad to be informed of the percentage of accuracy obtainable by this process. **Samuel Purnell.**

San Francisco, *April* 10*th*, 1883.

A. Petersen.—Your quadruplex system, although ingenious, is no improvement on the existing apparatus. At present, in this country, only two keys without a pole changer or duplex transmitter (current increaser) are employed for working the quadruplex circuits, so that one piece of apparatus less than that required in your own invention is used. As you arrange your system it is only possible to work the compound relay by *doubling* the current strength.; this is not sufficient for general purposes, the increase of current generally required to obtain satisfactory working is from 1 to 3; this your arrangement does not admit of.—EDS. ELEC. REV.]

Secondary Generators.—We have received from Messrs. Gaulard & Gibbs a very long letter on the subject of their secondary generators, which we recently described. We regret that want of space will not allow us to publish it till next week.—EDS. ELEC. REV.]

Long-Distance Telephony.—In answer to Mr. Barney's letter of last week, we would remark that both long-distance telephony and fast speed automatic telegraphy are dependent upon two elements, viz., the conductor and the instruments; and the two problems can be solved either by making the conductor of very large dimensions, or by improving the instruments, or by both. If the problem is to be solved by making the conductor of large dimensions capital only will be required to effect this. If the problem is to be solved by means of the instruments, "considerable advances require to be made in their construction before further success can be obtained." Our two statements *can*, therefore, we think, be reconciled. If such improvements are made in the instruments as will enable long-distance telephony to be carried on over a wire of the ordinary gauge, the expense of effecting the long-distance communication would obviously be very much less than would be the case if the result were obtained by increasing the gauge of the conductor; the cost of improving an instrument (supposing such improvement to be possible) would certainly be very much less than the cost of erecting a large conductor, and although in a few cases capital expended on copper and iron may insure a good return, yet these cases must be very few. The possibility of effecting a particular result at an enormous cost does not make that result a commercial success. Our correspondent's statement with reference to the Hopkins and also the Lockwood-Bartlett instruments does not alter our opinion with reference to the cause of the success obtained over the 1,000 miles line; in other words, we consider that almost any of the existing instruments other than those referred to would have enabled telephonic communication to have been carried on with success, and we also think that if a line is such that the ordinary instruments fail to work on it, then the substitution of the Lockwood-Bartlett or Hopkins instruments would not do much to render working possible.—EDS. ELEC. REV.]

The Telephone in Brooklyn.—The telephone business in Brooklyn is now under the control of the Long Island Telephone Company, which has doubled its subscription-list since last July. Then it had 800 subscribers, and now it has 1,600. The company has extended its lines to Flushing, College Point, Whitestone, and Bayside. It is building lines to Jamaica, Far Rockaway, Hempstead, Babylon, and Patchogue, and expects ultimately, probably during the summer season, to reach to the other end of the island. In Brooklyn about 5,000 messages pass over the wires daily, and between Brooklyn and New York the number is some 30,000.

NOTES.

Electric Lighting.—In the House of Commons, yesterday week, Mr. Chamberlain, in reply to Mr. Yorke, said it was true that some of the local authorities in the Metropolis were anxious to have an extension of time for considering the question of establishing electric lighting in their districts; but he found that any such extension, if granted, would render any provisional order for the present Session impossible, owing to the standing orders in the other House. Many of the local authorities in London, and also in the country, had come to satisfactory arrangements; and, in his opinion, they had had ample time for the consideration of the subject.

The Bernstein incandescent system of electric lighting has just lately been inaugurated in Boston. The distinguishing feature of the lamp, which is the invention of Prof. Alex. Bernstein, is the use of a hollow cylinder of carbon instead of a slender filament. By this means, it is said, that six times greater lighting surface is secured than in the ordinary filament lamp, with a small cross-section to be heated; the resistance is very low and the current is less powerful, and the life of the lamp is far greater.

The *Boston* (U.S.A.) *Evening Transcript*, in referring to electric companies generally, says the best that can be said in their favour is that they are now endeavouring to do as little business as possible, for the more they do the more they lose. Of electric lighting companies there were two classes; the first had stock for sale, and cared little to sell electric lighting. The second class were honestly managed by men of means, who offered no stock for sale, but were charging off their investment to profit and loss, and frankly confessing that until the business was reorganised upon a different basis, or new appliances had proved successful, there was no money in it, and that the more the business was extended the greater the amount of money lost.

At the International Fisheries Exhibition, which will now soon be opened, Messrs. Siemens Brothers are getting on with the preparations for lighting the long southern arcade with incandescent lights, and this long, arched avenue will, when illuminated by its 1,000 Swan lamps, form an exceedingly pretty sight. The ribs, or, roughly speaking, horse-shoe shaped arches, about 10 ft. apart, are left bare, and from the spring of the arch the space overhead is, as it were, segmented by 13 short pendants or tie-boards, of which the projecting ends converge towards the medial line. On every point glistens a lamp, and when the many rows of these thousand starlike points of light are seen with the effect of perspective in the long arcade, it may be imagined that the scene will be such as electrical science has never before produced.

It is proposed to light the new hotel at Loch Awe, Argyleshire, by electricity.

A private company formed by influential houses in London and Mexico have made arrangements with the authorities of the City of Mexico for the lighting of their town and its suburbs by the Brush electric light. It is said that these arrangements have been concluded after a series of successful installations in the city itself, and in other towns throughout the Republic.

A Birmingham contemporary reports that there is a growing trade in that town in electroliers and brackets adapted to electric lighting purposes.

The contract between the Gas Committee of the Aberdeen Town Council and the Brush Electric Light Company (Scotland), expired last Saturday evening, when the experimental lighting of the leading thoroughfares of the city was concluded. The lamps were lighted on the 24th December, 1882, so that the trial lasted a little over four months. Opinion is divided as to its success. Mr. Martin, who has had charge of the installation, has from first to last been most assiduous in the discharge of his duties, and in quitting Aberdeen leaves behind him many friends.

In addressing the half-yearly meeting of the North of England Gas Managers' Association, held at Newcastle-on-Tyne last week, the President remarked that "perhaps at no period had gas men so thoroughly understood their position and duties as they did at present. The knowledge of the ablest scientists had been utilised to make electricity supplant gas, but the latter was being used more and more, and the residual products, which at one time were considered worthless, were now making good advancing prices."

The Corporation of Leeds voted £10,000 on Wednesday to apply the electric light to the Town Hall, the new municipal offices, and a few of the principal streets in the borough, preparatory to the general application of the light if the experiment proves satisfactory.

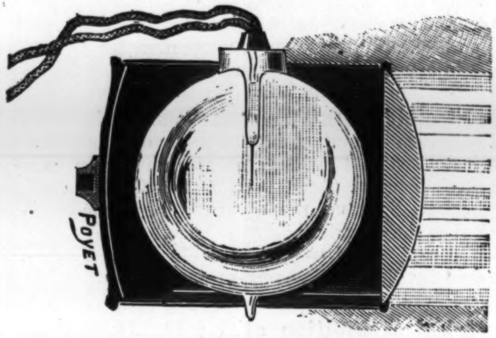
In the seventeenth bulletin of the Edison Electric Light Company of New York it is stated that in the first district of that city the company is lighting 368 houses wired for 8,117 lamps. The building of the Western Union Telegraph Company is to be lighted from the Pearl Street station by a special conductor, connected with the net-work of conductors in the first district at Nassau Street. The building is being wired for 345 lamps, but for the present only about 255 will be used. On the continent of Europe the machine works of M. Labrador, at Madrid, Spain, are already lighted, and 1,000 lights are now being made to light the depôt and post-office at Stuttgart, Germany; while at Dijon, France, the Edison Company is just establishing a central station. At Ivry-sur-Seine the Edison factory is employing 200 workmen, and the portion of the factory which is devoted to the manufacture of lamps is turning out 400 lamps a day, to say nothing of dynamos and other apparatus. During the recent court ball at Vienna the Imperial palace was also illuminated by the Edison light. In Cuba the office of the *Diario de la Marina* (newspaper), in Havana, is lighted by the Edison system, as are also several sugar estates on that island; while in South America several mills and private houses are lighted from the central station at Santiago, Chili. There is also an interesting account of the engine "Lawrence," which in March last performed the unprecedented feat of running at a speed of 350 revolutions per minute for 17 days without stopping—a number of revolutions which in a locomotive would have been equal to a journey around the world.

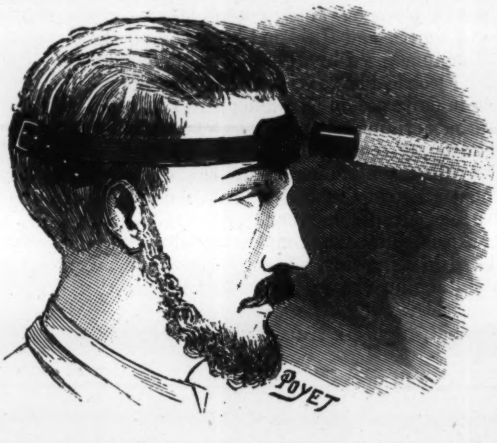
The Fyfe-Main Electric Lighting and Construction Company has, within the last few days, brought out an arc lamp which is practically as steady as the incandescent system, and when the amount of light is taken into account it is of course much cheaper. We hear most favourable reports as to the wonderful steadiness of this improved lamp—a steadiness due, we believe, to a more delicate and continuous feed—but we cannot verify them from personal observation, although we hope shortly to be able so to do.

The Cost of Electric Lighting.—Mr. J. E. H. Gordon, the manager of the electric light department of the Telegraph Construction and Maintenance Company, writes to the *Times* of the 2nd inst. as follows:—"As so much has been written lately about the probable cost of electric light plant, the following notes of a specification which this company has lately furnished to the Corporation of Nottingham may be of public interest, as showing not probable cost, but the price at which a responsible manufacturing company will undertake to erect the plant and to guarantee its successful working. The estimate is for a plant for 60,000 20-candle Swan lamps, and includes condensing engines, boilers, dynamos, street mains, buildings, &c., and the successful working of the plant for 30 consecutive days and nights. The current is to be supplied from five dynamos of 15,000-light capacity each, four being at work and one with its engines and boilers in reserve. The dynamos run at 150 revolutions per minute, and are without belts or rubbing contacts. The mains are to be such as to allow the current to be supplied at a pressure of 70 volts. Our price for the whole is £220,000. We have worked out the estimated working cost, as compared with gas, at 2s. 6d. per 1,000 cubic feet. Steam coal in Nottingham being 10s. per ton, we find that, including depreciation, coals, oil, wages, rates, renewal of Swan lamps, &c., if a 20-candle Swan lamp is supplied at the same price per hour as a 14-candle gas burner, the profits will pay 23¼ per cent. on the £220,000 capital; or that, if the Corporation are content with 6 per cent., they can supply electricity, lamp for lamp, at 60 per cent of the price of gas; or, allowing for the difference of candle-power, at 42½ per cent. of the cost of gas, or considerably less than half. We hope, therefore, that electric lighting is now in a fair way to become a practical success, and not only a scientific one. Of course it is only by working on a large scale that such results as these can be obtained."

[Since this letter appeared we have received a copy of the specification referred to, but too late for us to comment upon this week.]

Electric Frontal Photophore.—At the meeting of the Académie des Sciences, on the 16th April, M. le Dr. Bouley presented, under the name of MM. P. Hélot and G. Trouvé, a medical electric light apparatus, which consists of a small incandescence lamp (Swan) contained in the hollow of a metallic cylinder, between a reflector and a small convex lens. This apparatus, which is very light, is applied to the forehead by means of an elastic strap, and furnishes a very intense light, of which the field can be altered by a slight displacement of the lens. The source of electricity is a bichromate of potash battery, similar to that which we described on page 349, of last week's issue, but which contains only four elements in series. This apparatus is intended for illuminating natural cavities or a deeply seated operating field, the surgeon being able to direct his light at will, and instantaneously by slightly turning his head, both hands being entirely free.





Brush v. Van de Poele.—In the United States Court at Chicago, on the 5th ult., Mr. Charles T. Brush and others filed bills against the Van de Poele Electric Light Company and J. Irving Pearce to restrain them from using the Brush patents, issued October 23, 1877, for improved metal-plated carbons.

Miners' Electric Safety Lamps.—A correspondent, writing to a contemporary, says that the keen competition now observable with the view of providing a perfect safety lamp for miners, evoked partly by Mr. Ellis Lever's offer of a premium of £500 for such lamp, and partly, no doubt, by other causes, will probably result in the general use of electricity for lighting mines, and the substitution at no distant date of an electric safety lamp in lieu of the old "safety lamp." The number of applications for the terms and conditions of the competition is already very large, and there can be little doubt that a lamp will be forthcoming which will fulfil the conditions as to portability, light, and safety, and thereby secure the prize.

The Future Prospects of Electricity.—Mr. T. P. Barkas, F.G.S., delivered a lecture on this subject to the Tyneside Student's Association, Newcastle, last week, in the course of which he said electric lighting and power were both practicable, but as our knowledge of applied electrical science at present stood, neither were commercially profitable in opposition to gas and steam. He was hopeful, however, that the day was not far distant, when by some simple improvement in the development and application of the unlimited force of electricity, they might have lighting, heating, and practical mechanical power, produced more easily and cheaply than they were now by the various agencies in common use.

The Electric Light Wanted.—During the temporary darkness which prevailed in the City one morning last week, Mr. Justice Pearson, who was sitting in the Lord Chancellor's court at the Royal Courts of Justice, directed the ushers to light up the court. Whereupon it was discovered that the electric light system had not been extended to that court. Wax candles had, in consequence to be resorted to for illuminating purposes.

Electrical Exhibition at Kirkcaldy.—On Friday and Saturday of last week, the first Conversazione of the Kirkcaldy Naturalists Society was held in the Public Building, Kirkcaldy, and proved a complete success. Amongst the exhibits, which were numerous and valuable, were many electrical appliances, which attracted much attention. Mr. Ernest Shepherd of Rossend Castle, Burntisland, showed, in action, a four-inch spark induction coil working vacuum tubes and gas pistols. Tait's double chambered air-pump with luminous globes, electro-motors of various kinds, telegraph and telephone instruments, batteries of Wollaston, Smee, Bennett and Leclanché types, and the large electric gong, manufactured by Julius Sax, London, and exhibited at the late Electrical Exhibition at the Crystal Palace, and which is now in daily use on Mr. Shepherd's telephone line. One of Edison's original phonographs was exhibited by Mr. Allan Mathewson, of the Dundee Naturalists Society. The rooms were brilliantly illuminated by the electric light, by the National Electric Company of Glasgow, under the superintendence of Mr. J. J. Mann. A large uncovered arc lamp was suspended above the entrance, and being the first exhibited in Kirkcaldy, was a source of great attraction, and notwithstanding the inclemency of the weather drew large crowds. Mr. Sang, the Hon. Secretary of the Society, carried out, highly satisfactorily, the whole of the arrangements.

Incandescence Electric Lamps.—We have received from Mr. Henry F. Joel, C.E., the following comparative tests of different incandescent lamps at 20 C. P.

Name.	Resistance Cold.	Ampères.	Volts.	Watts.	Remarks.
Maxim	66	1.56	56	87.36	Average of 7 lamps.
Do.	110	1.1	65	71.5	Average of 5 lamps.
Swan	150	1.38	93	128.34	Average of 2 lamps.
Do.	67	1.5	51	76.5	One lamp.
Do.	63	1.45	47	68.15	One lamp.
Woodhouse & Rawson	69	1.58	57.5	90.85	Average of 10 lamps.
Duplex	130	1.32	94.4	124.708	Average of 10 lamps each tested in series.
Edison	245	0.82	112	91.84	Average of 10 lamps.
Gatehouse	120	1.0	64	64.0	Average of 10 lamps.
Do.	100	1.25	54	67.5	Average of 10 lamps.
Do.	150	0.9	72	64.8	Average of 10 lamps.

All the above tests were made with the same instruments and under the same conditions, 20 candle-power being observed throughout.

The Electric Motor Syndicate (Limited).—A copy of the prospectus of this Company has been forwarded to us. We do not know anything of the patents of Messieurs Piot and John MacDonald, whose inventions the Company proposes to work, and therefore can at present express no opinion on that portion which refers to the patents. Respecting the remainder, there are two things which attract our attention, one is, that it seems to us questionable policy to start the list of the "Committee of Direction" with a name which figures prominently on the directorate of a company, just now not looked upon favourably by the investing public, namely, the Maxim-Weston Electric Light Company, Limited; the other is, that, as only £6,000 worth of shares are offered to the public (£6,000 having already been allotted) it will be unnecessary to criticise minutely the details of so long a prospectus. If but few of the newspaper quotations given therein have any special reference to, or warrant from, the good qualities of the machine it is proposed to employ, the capital asked is so very moderate that the public cannot be very great losers, even if the enterprise should not bear out the hopes, expressed or implied, of those who have concocted the document under notice.

Sixpenny Telegrams.—In the House of Commons on Thursday week Mr. Dawnay asked the Postmaster-General, in view of the proposed alteration with regard to 6d. rates for telegrams, an alteration which it is computed will entail a loss of £170,000 a year, what arrangements would be made in the case of the rural post offices, where contracts had been signed under which the shillings at present paid in for telegrams were allowed to the guarantors of the annual sum paid to the Post Office department; and, whether the guarantors of such sums would be secured from any share in the loss which it was calculated would be entailed on the revenues of the department by the change in the telegraphic rates. Mr. Fawcett in reply, said he thought it would be only fair that guarantors should not suffer any pecuniary loss from proposed reduction of telegraphic charges, and they would not therefore be called upon to pay any more than payment made in the last year, or the average payment of the three last years.

The Sixpenny Rate.—The new sixpenny telegram rate is not expected to come into operation much before Christmas. The Post Office officials are preparing for the extra work by duplexing many of the metropolitan and provincial circuits and issuing fast speed instruments for the existing duplexed circuits.

Winding-up Petition.—A petition for the winding-up of the British and Irish Telephone and Electric Works Company, Limited, is to be heard on the 11th inst.

The Government Patent Bill.—We have received a copy of a petition of the Croydon Public Affairs Committee, presented to the House of Commons by Mr. Grantham on the 18th ult., in favour of cheap and effective patent-right. We cordially sympathise with the prayer of the petitioners in regard to the examination of applications and the reduction of fees, on which subjects their views very much accord with those advocated in the articles we have recently published on the patent question. We heartily wish them every success in their efforts on the behalf of that meritorious but not always well used class—inventors and patentees. We cannot, however, refrain from pointing out one or two errors into which the memorialists appear to have fallen. It is scarcely correct to say that the person who procures the Great Seal first is the patentee. It is true that in the famous case of Bates *v.* Redgate, the then Lord Chancellor, Lord Hatherley, did so decide, and in cases of opposition the law officers have since frequently been guided by this decision; but although it is always desirable for a patentee to secure his seal as quickly as possible, yet it is pretty well understood now that judicial tribunals are opposed to any such inequitable construction of the law. The first applicant holds the priority, and even the filing of a complete specification by a second applicant will not deprive the former of his right, as the petitioners also assume in the memorial before us. These slight inaccuracies, to which we thought it well to direct attention, do not affect the main line of argument advanced in favour of cheap and effective patent right, which we trust will meet with the consideration it deserves at the hands of the Grand Committee.

Telephones in Holland.—The Bell Telephone Company, established in Holland for the last two years and a half, counts at present about one thousand subscribers. In Rotterdam, where the company opened to the public on March 1st, 1882, the number of subscribers amounts to 378.

Telephonic Communication in the City.—Not a little inconvenience is caused in the City by the unaccountable delay which frequently occurs when communication by telephone is desired. We refer especially to the experience of offices which are in connection with the central department of the United Telephone Company. To those who are familiar with the extent to which the telephone is utilised in America, and with the facilities provided for the convenience of customers, the slow deliberation manifested in the mode of transacting telephone business in London cannot fail to be irritating. There is certainly no reason why the great centre of the world's business should lag behind small towns in the United States and in Canada. *Verb. sap.*, and we hope soon to know that a change for the better has taken place.—*Bullionist.*

Telephonic.—On Friday week telephonic communication was established between Mr. Fraser's hotel at Dalmally and his new hotel at Loch Awe, distant about four miles. This is said to be the first application of the telephone in Argyllshire. The *matériel* was supplied and fitted by Messrs. Westwood, Sons and Millar, of Dundee and Perth.

The Long-Distance Telephone Co. (Limited).—This is the name of a new company, the prospectus of which has been advertised this week. The capital is £600,000, in 120,000 shares of £5 cash, of which 35,000 (£175,000, besides £25,000 cash and one-third of any extra capital issued) are to be allotted to the vendor, fully paid up. It (the company) proposes to use patents Nos. 686, 687, 688, 689, of 1882, with all rights in the same for home and abroad, the foreign patents to be taken out by the original patentee. Patents 688 and 689 are those respectively for the receiver and transmitter, and abstracts of these appeared in our issues of September 16th and 23rd, 1882. Prefacing the prospectus several newspaper "notes" are reprinted, showing tests which have been made in the United States. One is to the effect that 400 miles of wire have been freely talked over; that is 200 miles going and 200 for the return. Another says 1,100 miles distance has been talked over, but that, we believe, was when using the special expensive wire, which was critically referred to on p. 282 of our issue of April 7th, 1883. One advantage claimed for the system is that it does "overcome to a large extent that very disagreeable and common defect (induction), which is found in all the telephones now in use." We fail to perceive any real reason for this statement; but it is evident to us, and will be so to most of our readers, that no trials in America will be held so satisfactory as one good trial of 200 miles in England, taking one town *en route* which has several telegraph lines running into it, and which test should be made when these adjacent wires are in use. If the said instruments will enable conversation to be held without too much interference from induction and other causes, and are also clear of other patents, then we shall gladly hail the company as assisting in giving that popularity to telephonic communication which it is destined very shortly to attain. Of genuine workers in this field, those possessing good apparatus are to be welcomed. We do not perceive anything in the prospectus about the proportion of receipts to be paid to the Post Office Department for use of trunk wires, but in estimating the revenue as set forth this should, we think, have been mentioned. The Department has, by the Telegraph Act, rights over trunk line communication from town to town which it has never yet shown signs of abandoning. In connection with the subject of patents alluded to previously, we notice an advertisement of the United Telephone Company claiming the Hopkins' receiver and transmitter to be infringements of the Bell and Edison patents.

London and Globe Telephone Company.—As may be seen from an advertisement in our pages, this company is now booking subscribers. It adopts a moderate subscription, intends to avoid delays, and will give an uninterrupted day and night service. These are good objects at which to aim, and we wish it all success in its endeavours.

New Book.—We understand that a third edition of Mr. H. R. Kempe's "Handbook of Electrical Testing" is in course of preparation.

Society of Telegraph Engineers and of Electricians.—At the meeting of the society, to be held at 25, Great George Street, at 8 p.m., on Thursday, May 10th, the following papers will be read:—"The Electric Holophote Course Indicator for the prevention of Collisions at Sea," by J. H. A. Macdonald, Q.C., associate; "Electromotors and their Government," by Professors W. E. Ayrton, F.R.S., and John Perry, members.

The Charing Cross and Waterloo Electric Railway Bill.—On Tuesday morning, when the Select Committee of the House of Commons, presided over by Admiral Egerton, met for the purpose of inquiring into the merits of this Bill, it was announced on behalf of the promoters that it was their intention to withdraw the bill for the present session.

NEW COMPANY REGISTERED.

Telephone Company of Austria (Limited).—Capital £100,000, in £5 shares. Objects:—To acquire certain concessions from the Austrian Government for establishing telephonic communication in the towns of Prague, Graz, Trieste, Lemberg, Reichenberg, Pilsen, Czernowitz, Belitza-Biala and Cracow. Signatories (with one share each):—*Col. G. E. Gouraud, Upper Norwood; *Patrick Carnegy, C.I.E., Norwood; E. F. Powers, Langham Hotel; R. H. Krause, 34, Walbrook; T. Taunton, Farringdon Road; T. L. Scott, 256, Liverpool Road, N.; F. P. Shuckan, 1, Darley Villas, Melbourne Grove, S.E. The Honourable H. Spensley is appointed a director. Directing qualification, 50 shares; remuneration, £1,200 per annum, provided that if the number of directors is greater or less than five the sum shall be increased or reduced, as the case may be, £200 for every director. Registered 27th ult., by Ashurst, Morris & Crisp, 6, Old Jewry.

* Signatories whose names are preceded by an asterisk are also directors.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Albion Electric Lamp Company (Limited).—The second return of this company, made up to the 3rd ult., was filed on the 24th. The nominal capital is £10,000, in £10 shares. The number of shares taken is 886. Upon 195 shares (the first issue) the full amount has been called, and 2s. 6d. upon the remaining 691 shares. The calls paid amount to £2,036 7s. 6d. Registered office, 16, West Street, Gateshead.

Anglo-Spanish Brush Electric Light and Power Company (Limited).—The second return of this company, made up to the 28th of March, was filed on the 27th ult. The nominal capital is £200,000, in £5 shares. 8,907 shares have been taken up and £3 per share has been called thereon. The calls paid amount to £25,443 10s., leaving £1,277 10s. unpaid. Registered office, 19 and 20, Queen Victoria Street.

Northern District Telephone Company (Limited).—The second return of this company, made up to the 23rd ult., was filed on the 30th ult. The nominal capital is £100,000, divided into 2,500 preference shares of £10 each and 15,000 ordinary £5 shares, the latter being issued as fully paid. 837 preference shares have been taken up, and the full amount called thereon, the calls paid amounting to £6,611 15s. 9d., leaving £1,323 4s. 3d. unpaid. Registered office, 13, Exchange Buildings, Quayside, Newcastle-on-Tyne.

NEW PATENTS—1883.

1983. "Manufacture of subterranean electric cables." H. J. ALLISON. (Communicated by S. F. Shelbourne.) Dated April 19. (*Complete.*)

1991. "Improvements in the construction of dynamo-electric machines, and in bobbins or Gramme rings therefor." W. P. THOMPSON. (Communicated by B. Cabella.) Dated April 19.

1992. "Engines and driving-gear for electric machines. R. BROWN. Dated April 19.

1998. "Electric batteries." B. W. WEBB, H. P. F., and J. JENSEN. Dated April 19.

2020. "Telephone or telegraph call apparatus and circuit arrangements." H. A. C. SAUNDERS and A. C. BROWN. Dated April 20.

2023. "Supplying, maintaining and regulating electrical force for battery charging, and other purposes." R. P. SELLON. Dated April 20.

2025. "Improvements in and relating to apparatus to be used in telephonic systems for putting any of the instruments connected with a central station into communication with each other." W. R. LAKE. (Communicated by H. T. Cedergren and L. M. Ericsson.) Dated April 21.

2028. "Apparatus and processes for generating, regulating, and measuring electric currents." Sir W. THOMSON. Dated April 21.

2031. "Primary voltaic batteries." P. JENSEN. (Communicated by A. Prinz, W. Wenzel, and J. Kahn.) Dated April 21.

2042. "Improvements in magneto-electric machines and dynamo-electric machines, and in electro-motors." G. HOOKHAM. Dated April 21.

2044. "Dynamo-electric machines." A. M. CLARK. (Communicated by Solignac et Cie.) Dated April 21.

2057. Electric lamps and circuit connections, and apparatus for the same." W. HOCHHAUSEN. Dated April 23.

2058. "Magneto and dynamo-electric machines and apparatus connected with the development and regulation of electric currents." W. HOCHHAUSEN. Dated April 23.

2062. "Thermo-electric generators." H. WOODWARD. Dated April 24.

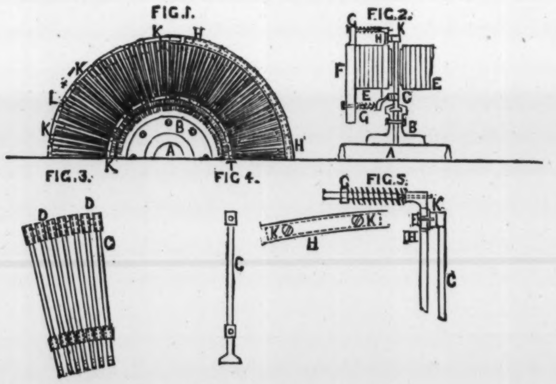
2064. "Preventing excessive heat in dynamo-electric machines." H. ROBERTS. Dated April 24.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

3583. "Electric lamps, &c. G. HENLEY and S. GEDGE (executors of W. T. Henley, deceased). Dated July 28. 1s. 2d. Consists in improved methods of constructing the apparatus for regulating the distance between the carbons as they burn away by the electric current, and an apparatus in connection with the same.

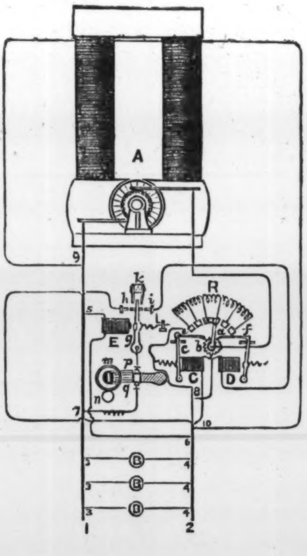
3779. "Electric lamps." B. J. MILLS. (Communicated from abroad by W. M. Thomas, of America.) Dated August 9. 8d. The improvements are designed for the equalisation of arc lamps when used "in series."

3950. "Dynamo-electric machines." S. Z. DE FERRANTI and A. THOMPSON. Dated August 17. 6d. Has for its object improvements in dynamo machines or electric generators and apparatus connected therewith.



Figs. 1, 2, 3, 4 and 5 illustrate the improvements in continuous current dynamo-electric machines. Fig. 1 shows a side elevation of one-half of a wheel, with copper bars radiating out from it, and with contact plates bearing against them as above described. The position of the field-magnets is also shown. Fig. 2 is a transverse section of the same. Fig. 3 shows a side elevation of some of the bars on a larger scale. Fig. 4 shows another elevation of one of the bars, the side shown in this figure being one of the sides at right angles to the side shown at fig. 3. Fig. 5 shows on a larger scale the way in which the metallic contact-pieces are carried and held up to the radial copper bars. In these figs., A is a revolving axis carrying the wheel, B, formed in two halves bolted together, and clamping between them the inner ends of a number of radial metallic bars, C, preferably of copper. The radial bars might, however, be otherwise carried from the wheel, and if desired, their outer ends might be secured to a metallic tyre but insulated therefrom. Between the outer ends of the radial bars are placed distance-pieces, D, of non-conducting material. When the bars, C, have been ranged in a circle around the shaft, and the distance-pieces have been put into place between their outer ends, the two halves of the wheel are drawn together so as to make them grasp the inner ends of the bars; the bars are then all drawn inwards towards the shaft by the action of inclines on the two parts of the wheel, acting against inclines on the inner ends of the bars. E E are the field-magnets, their poles are made to be alternately north and south, as above explained, they are carried by fixed supporting-rings, F. One of the rings, F, has rods, G, standing out from it at intervals, one set of rods outside the magnets, the other set on the inner side of the magnets. H I are two rings, each having lugs projecting out from them; the lugs of the larger ring, H, are free to slide to and fro along the outer set of rods, G, and the lugs of the smaller ring, I, upon the inner set of rods, G. Around the rods are spiral springs which keep the rings H and I pressed towards the bars, C, which radiate out from the revolving wheel. The face of each ring which is towards the radial bars, C, carries a number of metallic contact-plates, K, which are insulated from the rings and from one another. By the action of the spiral springs they are kept against the radial bars. The breaks between the contact-plates or rubbers carried by the outer ring are as shown opposite the centre of every other radial space between the field-magnets, whilst the breaks between the contact-plates or rubbers carried by the inner ring are opposite the centres of the intermediate spaces. The radial bars with the two sets of contact-plates or rubbers thus make a continuous zig-zag metallic circuit. If a single current only is to be taken from the machine one only of the rubbers, or contact-places, will be cut through at its centre, as shown at L, fig. 1, and an insulating conducting-wire will be led from one half of the contact-plate to an insulated terminal, and so to the line wire of the circuit, and similarly the other half of the ring will be coupled to a second terminal for the return current to complete the circuit, or if a greater number of circuits is to be taken from the machine, a greater number of contact-plates or rubbers will be cut through, and the currents will then be taken off at one-half of each contact-plate and returned through the next succeeding half-contact plate, which by the zig-zag metallic connections above described, is in electrical connection therewith. In place of metallic contact-plates or rubbers being used to complete a continuous zig-zag circuit through the radial bars of the revolving wheel, other ways of completing a like continuous zig-zag circuit through the bars might be employed. In place of the radial bars being revolved they might be stationary and the magnets revolved. The magnets also might be placed in the centre between two armatures made up of radial bars and contact rubbers, or equivalent contact apparatus.

3996. "Dynamo and magneto-electric machines." T. J. HANDFORD. (A communication from abroad by T. A. Edison, of America). Dated February 20. Has for its object the provision of simple and efficient means for automatically regulating the generative capacity of dynamo or magneto-electric machines, supplying lamps or motors arranged in multiple arc. One part of the said invention relates to apparatus which will regulate for changes in the speed of the engine as well as in the number of translating devices, and keep the candle-power of the lamps constant and prevent flicker. This part of the invention is illustrated by the figure. A is a dynamo or magneto-electric machine, from which run the main conductors, 1, 2, in multiple arc circuits, 3, 4, from which are arranged the lamps (for example), B. R is the resistance which may be located in either 1 or 2, but is represented as located in 2, between the lamps and the generator. This



resistance is thrown into and out of circuit by the arm, *a*, which is moved in one or the other direction by two ratchet wheels, one of which is shown at *b*. C D are electro-magnets, the armature levers, *c*, *d*, of which carry pawls, *e*, *f*, working the ratchet wheels. E is an electro-magnet in a multiple arc circuit, 5, 6, connected with 1, 2 beyond the resistance, R. The armature lever, *g*, is in another multiple arc circuit, 7, 8, which is divided at the front and back contacts, *h*, *i*, of this lever; the divisions of this circuit pass through the coils of the two electro-magnets, C, D, and are again joined. The lever, *g*, is held in a central position by spring fingers, *k*. The retracting spring, *l*, of the lever, *g*, is made adjustable, so that the candle-power of the lamps may be adjusted at this point. The circuit, 7, 8, has arranged in its line a mechanical circuit breaker, which may be a wheel, *m*, riding upon the armature shaft, *n*, a detached portion of which is shown for clearness of illustration; the wheel, *m*, carries a breaking cylinder, *o*, composed of metal and insulation, upon which cylinder rest spring fingers, *p*, *q*. The circuit wires run to these spring fingers, the revolution of the cylinder alternately making and breaking the electrical connection between such fingers. In the condition of the parts represented in the drawings the lever, *g*, is held in its central position by the spring fingers, *k*, the candle-power of the lamps being normal. When the current increases to a definite extent the lever, *g*, will make its front contact, *h*, completing circuit through C and causing its lever, *c*, to vibrate with the assistance of the circuit breaker. This movement will, through the intervention of the pawl, *e*, turn the ratchet wheel and thence the arm, *a*, so as to throw more of the resistance into the main line or conductor until the candle-power of the lamps becoming normal the lever, *g*, resumes its central position breaking the circuit, 7—8. Upon a definite decrease of current the lever, *g*, will make its back contact, *i*, energising D and vibrating the lever, *d*, with the assistance of the circuit breaker. The pawl, *f*, will then actuate its corresponding ratchet wheel and move the arm, *a*, so as to cut resistance out of the main line or conductor until the candle-power of the lamps again becomes normal, when the lever, *g*, will resume its central position as before. The field of force circuit of the machine is a multiple arc circuit, 9, 10, from 1, 2; the connection being made beyond the resistance, R, as shown, so that it will be affected by such resistance like the lamps, and will receive more current when resistance is cut out of the main line and less current when resistance is thrown into the main line.

4005. "Non-conducting tubes for electrical purposes, &c." J. C. Marsh and R. J. Smith. Dated August 21. 6d. The objects of the invention are, to construct non-conducting tubes, suitable for carrying, enclosing, and protecting electrical wires, for electric lighting, telegraphic, telephonic, and power-conducting purposes, in underground and other situations; and also to construct such tubes of a thoroughly vitreous material, such material being also applicable to the formation of tubes and pipes for other useful purposes than those connected with electricity.

4025. "Working gear and appliances used in electric lighting." K. W. Hedges. Dated August 22. 6d. Relates partly to an improved method of controlling from a distance the speed of any motor used for driving the generator of electricity for lighting purposes, or for controlling the electromotive force of the same. Relates further to improvements in the switches and safety plugs used with incandescent lights, and also to a means of rapidly switching out any number of these lights with the minimum amount of sparking at the contacts of the switch.

4044. "Telephone receiving apparatus." R. Theiler and M. Theiler. Dated August 23. 6d. This invention partly relates to an improvement in, and connected with, the telephone receivers, in respect of which letters patent were granted, dated November 16th, 1881. According to the said former letters patent, the latent vibrations of an electro-magnet, when under the influence of a vibratory current, were communicated to a tympan or diaphragm. Now, according to the present invention, the said lateral vibrations are communicated to a stem or knob of ivory, wood, horn, or any other suitable substance, of such a shape that it can be conveniently inserted into the aperture of the ear, or pressed against the ear. Fig 1 shows that part of the invention which relates to an improvement in and connected with the telephone receivers in respect of which letters patent were granted, dated November 16th, 1881. Instead of attaching the free end or pole, N, of the laterally vibrating electro-magnet, E, a stem or knob F, by means of a screwed pin, S, as shown in fig. 1. The inventors generally make this stem or knob of one of the shapes shown in figs. 1, 2, 3, and 4, and find it advantageous to drill a hole through it, as shown by the dotted lines. The size and shape of this stem or knob may, however, be greatly varied, and also be made hollow instead of solid, as shown. The sounds communicated to the ear by means of this stem or knob are loudest when the latter is shaped, as shown in fig. 1, that is to say, when part of the knob, F, can be inserted into the ear, but perfectly distinct and sufficiently loud articulation if obtained with the stem shown in fig. 4, which ends in a flat knob. The electro-magnet, E, is firmly screwed into the case, A, in the manner shown, and the ends of the helix are generally connected to a flexible conductor, and the apparatus is connected with the line wire in the usual manner. R is a ring by which the instrument can be hung up when done with. Fig. 5 shows the construction of a telephone receiver, in which the stem or knob, F, hereinbefore described, is attached to a free end of a tongue or bar, W, of soft iron, which is capable of vibrating close to the pole or poles of the electro-magnet, E. Either the electro-magnet, E, or the tongue, W, or both of them, may be permanently magnetised by induction, or consist of permanently magnetised steel.

FIG.1.

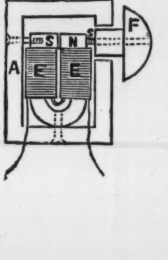


FIG.2.

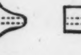
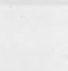


FIG.3



FIC4

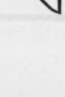
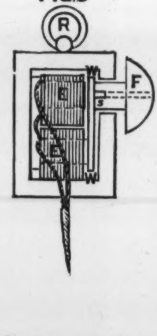


FIG.5



4046. "Electric arc lamps, &c." J. K. D. Mackenzie. Dated August 23. 6d. Has for its object to provide a contrivance for regulating the distance between the points of the carbons of arc lamps, which contrivance is extremely simple and inexpensive and at the same time secures steadiness of light.

4049. "Commutators for dynamo or magneto-electric machines." H. R. Lewis and W. C. Smythe. Dated August 23. 2d. Relates to commutators for dynamo or magneto-electric machines, and is designed to increase the efficiency of such machines and make them more readily applicable than heretofore to various kinds of work. (*Provisional only.*)

4065. "Electric lamps." C. S. Snell. Dated August 24. 2d. According to the present invention a rod carrying the upper carbon of an electric lamp passes through two coils, one of which is of thick wire and carries the main current, while the other is a potential or shunt circuit of fine wire, these coils being so arranged relatively to each other and to a piece or pieces of soft iron, that the magnetism of the latter tends to move the rod either by attraction or repulsion, in opposite directions. (*Provisional only.*)

4080. "Electric measuring, recording, and regulating apparatus." S. H. Emmens. Dated August 25. 2d. Relates to apparatus designed to measure the quantity and intensity of an electric current, and the resistance of a circuit, for recording the quantity of electricity traversing a circuit, and for regulating the production of an electric current in proportion to the resistance to be overcome. (*Provisional only.*)

4084. "Arc electric lamps." P. R. Allen. Dated August 26. 6d. Has for its principal object to preserve the moving parts of arc electric lamps from dirt or corrosion, so as to render unnecessary the frequent cleaning of the said parts which is at present needed.

4087. "Lighting of railway trains by electricity." H. E. Newton. (A communication from abroad by the Société Universelle d'Electricité Tommasi of Paris.) Dated August 26. 1s. This invention relates to certain improvements in a system based upon the simultaneous use of electric generators, taking their motion from one of the axles of the carrying wheels, and of accumulators or secondary batteries which provide for the supply of electricity to the lamps during stoppages, or when the train is running at a low speed.

4110. "Telephonic apparatus." G. L. Anders. Dated August 28. 2d. Relates to that class of telephones wherein a loose contact through which the current passes serves both for the receiving and transmitting instruments. (*Provisional only.*)

4111. "Dynamo-electric machines." H. H. Lake. (Communicated from abroad by S. F. Van Choate, of America.) Dated August 28. 8d. The object of this invention is to produce a dynamo-electric machine more simple, compact, economical, efficient and durable than other machines of like nature as heretofore constructed.

4127. "Electric controller and indicator for clocks, &c." T. Wright. Dated August 29. 6d. The inventor makes a controller which consists of a cogwheel with two ratchet wheels fixed on each side, working on an axis. The axis also bears two levers; at one end of each is a spiral spring, or weight, at the opposite ends are placed a click and an armature, communicating with a small toothed wheel, the axle of which also carries a circuit closer, viz., a wheel made of a non-conducting material, with a metal ring round it, from which project branches or pawls at certain distances. On this wheel press four steel springs, one which is connected to a terminal of the battery rests on the metal ring, two are connected to the ends of the coils of the electro-magnets under the levers, and the other one to the coil of the electro-magnet in the indicator, the corresponding ends of the coils being connected to the other terminal of the battery, or to earth. When one of the projections from the ring on the circuit-closer makes contact with one of the springs connected to the coil of an electro-magnet under the armature of one of the levers the latter is drawn towards the magnet by the current traversing the coil, but the instant the circuit is broken by the circuit-closer continuing its course, the lever is set free, the click is caught in the ratchet wheel, and the cogwheel being attached it is forced round by the action of the spring at the other extremity of the lever, thus communicating motion to the circuit-closer.

4147. "Galvanic batteries." S. H. Emmens. Dated August 30. 6d. Relates to an improved form of battery cell, and to certain novel combinations of electrodes and electrolytes and depolarising agents to be employed therein.

4148. "Generating, intensifying, and accumulating electrical energy." P. de Villiers. Dated August 30. 6d. Has for its object to provide improved apparatus for generating and accumulating or storing electrical energy. The said apparatus comprises an electric generator, an exciter or device designed to develop the greatest possible quantity of electricity from the generator, and an accumulator for storing the electricity produced by the generator and developed or intensified by the exciter.

4149. "Apparatus for hanging and removing electric lamps, &c." A. M. Clark. (Communicated from abroad by H. G. Fiske, of America.) Dated August 30. 2d. The object of this invention is to provide means of easily and rapidly removing electric lamps from their place when suspended for the purpose of removing carbons, repairing and replacing the lamp in suspended position. (*Provisional only.*)

4158. "Apparatus for measuring and registering electric currents." A. L. Lineff. Dated August 31. 2d. Relates to an apparatus for indicating the strength or measuring the quantity of electricity passing through any given circuit. (*Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the Letters Patent.*)

4159. "Telephonic apparatus." J. H. Johnson. (A communication from abroad by Doctor Arsène d'Arsonval, of Paris.) Dated August 31. 2d. Has for its object an improved construction of telephone which is distinguished by the employment of a coil moving in an annular magnetic field.

4160. "Telephonic instruments." J. D. Husbands. Dated August 31. 6d. Relates to further detail improvements in telephonic instruments of the class described by various examples in the provisional specification of the 24th June, A.D. 1882, No. 3,008.

4168. "Carbonisation and preparation of a material for the electrodes of arc lamps, &c." H. J. Marshall. Dated September 1. 2d. The object of the invention is the carbonisation of cane for use as the electrodes of arc or the filaments for incandescent electric lamps, and which material so carbonised and prepared may advantageously form porous carbon plates for secondary or polarisation batteries, or other batteries and instruments, and for other analogous electrical purposes. (*Provisional only.*)

4178. "Secondary or storage batteries." Desmond G. Fitz-Gerald and T. J. Jones. Dated September 1. 4d. Relates to improvements in secondary or storage batteries, and consists mainly in a practically efficacious method of utilising carbon generally in the form of rods, plates, or hollow cylinders of gas-carbon surrounded with or surrounding a mixture of fragments of the same material and metallic lead, or an oxide or insoluble salt of this metal, in the construction of secondary or storage batteries.

4180. "Carbons for incandescent electric lamps." J. Jameson. Dated September 1. 4d. Consists first in depositing a film or thin layer of carbon from gas or vapour upon a prepared surface of glazed porcelain or other suitable material by means of a high degree of heat, the porcelain being so shaped as that the ultimate shape of the carbon filament is produced by the deposit, and that severance merely of the deposit in one direction shall produce the filament, and next in the thickening of the ends of the filament formed by means of further deposit produced by exposure of the ends of the filaments only in suitable circumstances.

4186. "Construction of voltaic batteries." L. Hartmann. Dated September 2. 2d. The object of this invention is the production of a cheap, effective, and constant voltaic battery designed for domestic and public lighting and for other useful purposes where electric energy can be employed. (*Provisional only.*)

4192. "Electro hydraulic meter." R. Hammond and L. Goldenberg. Dated September 2. 2d. Relates to apparatus for the measurement of electric currents, by which it is enabled to record the consumption of electricity upon dial plates, by which the current is cut off when the meter ceases to act, and the action of which, being dependent upon the flow of water, is constant. (*Provisional only.*)

4198. "Galvanic batteries." E. B. Burr and W. T. Scott. Dated September 2. 4d. Relates to galvanic batteries, and is partly designed to improve the working of the apparatus described in the specification of former letters patent granted the 22nd day of December, 1881, No. 5604. The present invention is, however, applicable for other batteries.

4220. "Electrical regulation of steam power engines, &c." A. W. L. Reddie. (Communicated from abroad by A. Kràsza and J. Schaschl, of Austria.) Dated September 5. 4d. The operation of the electrical regulator, which forms the subject of the present invention, is based upon the effect produced by a coil of wire or solenoid, when a current is passed through it, upon a rod of iron. (*Provisional only.*)

4238. "Manufacture of incandescent lamps, &c." W. Crookes. Dated September 6. 6d. This invention has for its object improvements in the manufacture of incandescent lamps, and in apparatus therefor.

4246. "Electric signalling apparatus for telephonic purposes, &c." W. R. Lake. (Communicated from abroad by H. J. Cary, of America.) Dated September 6. 6d. Relates to electric signals, or signalling apparatus, of that class which are adapted to be used in circuits, in any number, known as individual signals, and arranged to be operated from a central station, in such a manner that the bell in the desired sub-station only of the whole series will be rung.

4248. "Galvanic batteries." G. C. V. Holmes and S. H. Emmens. Dated September 6. 6d. Relates to certain improvements in the construction of the cells and electrodes of galvanic batteries, whereby it is proposed to obtain a higher electromotive force and a stronger current than heretofore, by more convenient combinations of the elements, and improved construction of the electrodes; and these improvements are in part improvements upon an invention of S. H. Emmens, the provisional specification of which is numbered 4,147, and dated August 30th, 1882. The invention consists:—1st, in place of the compressed peroxide of lead specified in the aforesaid specification, 4147, 1882, in relation to the fourth form of cell, the inventors employ peroxide of lead in powder or cakes, such powder or cakes being placed in the inner or outer compartment of the cell as specified, and being separated from the zinc or lead electrode by any suitable porous pot or diaphragm. 2nd, The cell is of the ordinary Grove or Bunsen type, but the inventors use a packing of metallic peroxide or peroxides, such as peroxide of lead or peroxide of manganese, or a mixture of the two, in place of the nitric acid as a dehydrogenising or, as it is sometimes termed, depolarising agent; that is to say, they pack the porous pot or negative compartment of such cell with the peroxide in contact with the platinum or carbon electrode. Alternately they may make the porous pot itself of carbon, and they mix the dehydrogenising agent with some inert substance, such as granulated or broken carbon. 3rd. The inventors use an outer cell of any suitable material, and an ordinary porous pot as the inner compartment. The space around the porous pot they pack with the dehydrogenising agent as aforesaid, and inside the pot they place a mass of wire, granules or plates of zinc as the positive electrode. Alternatively the conditions may be reversed, the porous pot containing the dehydrogenising agent, and the outer space being packed by the zinc. 4th. The inventors surround the rods or plates of compressed or agglomerated peroxide of lead, specified by S. H. Emmens in 4,147, 1882, aforesaid, by coiled zinc wire, or by rings or washers of zinc, the two electrodes being separated by strips of wood or other suitable material. 5th. In place of any of the negative electrodes, as aforesaid, or in place of the inner electrode, as specified in relation to the fifth modification in Emmens' specification, 4,147, 1882, aforesaid, the inventors employ rods, cells, or blocks of carbon, or other suitable porous and conducting material, permeated with any of the aforesaid dehydrogenising agents, in the following manner. They first expose the rods, cells, or blocks, either in a wet or dry state, and where desired, in vacuo, to the action of the gaseous fluorhydride. Secondly, they impregnate them with a solution of some salt of the metal to be employed by soaking, hydrostatic pressure, or exhaustion. Thirdly, they decompose the absorbed solution by means of heat, electrolysis, or chemical means. The two last-named stages may be repeated as often as necessary. The zinc electrodes hereinbefore specified may alternatively be built up of layers of perforated zinc sheet.

4250. "Dynamo-magnetic electric machines, &c." T. Donnithorne. Dated September 6. 4d. Has for its object improvements in dynamo-magnetic electric machines, and in magnets to be used in such machines, and for other purposes.

4251. "Obtaining and utilising electric currents." T. Slater. Dated September 6. 2d. Relates to improvements in obtaining and utilising electric currents, and consists mainly in improvements on an invention for which letters patent were granted, bearing date the 3rd June, 1880, and numbered 2272. According to the present invention the iron core of the armature has a further internal core of soft iron insulated from the copper wire and extending across the armature from pole to pole. It has also a ring or tube of soft iron surrounding the entire armature externally from end to end. (*Provisional only.*)

4254. "Voltaic batteries." F. W. Durham. Dated September 7. 2d. In voltaic batteries, particularly such as are employed as secondary batteries, when an exciting liquid is used, the bubbling of the evolved gases through the liquid is apt to sputter portions of it on the exposed parts of the cells and casing, and the liquid film thus produced acts more or less as a conductor, causing leakage of the electricity. The invention relates to means of preventing such loss by leakage.

4260. "Electric governors for steam-engines, &c." A. Blechynden. Dated September 7. 10d. Relates, firstly, to governors actuated by electricity for steam-engines or other prime movers; secondly, to an automatic apparatus or governors actuated by electricity applied to regulate the opening of the dampers of steam-boilers, and, thirdly, to certain appliances by which the controlling power of any governor may be transferred to the hand of the attendant or *vice versa*.

4266. "Storing electric energy." T. Slater. Dated September 7. 2d. Relates to improvements in storing electrical energy. (*Provisional only.*)

4270. "Apparatus for generating electricity, &c." W. R. Lake. (Communicated from abroad by E. Brard, of France.) Dated September 7. 1s. This invention relates partly to the apparatus described in the number of the Electrical Review for September 9th, 1882; it also relates to improvements in the same as applied for lighting or heating purposes; its chief object is to enable various kinds of furnaces and fuel to be practically utilised for the production of electricity.

4273. "Casting metals for electrodes, &c." H. Woodward. Dated September 8. 4d. Consists in casting lead, or other metal, or alloys of metals, into porous or spongy plates, blocks, slabs, cylinders, or other suitable shapes in a particular manner.

4286. "Electric bell and signal apparatus." T. R. Brailsford. Dated September 8. 6d. Relates more especially to electric bell apparatus in which the bell can be rung from any one or other of a number of rooms or places, and in which on the ringing of the bell one or other of a number of indicators has at the same time to be moved to indicate from which room or place the bell has been rung; but the invention is applicable to signal apparatus used for other purposes.

4289. "Needle instruments for speaking telegraphs." E. J. HOUGHTON. Dated September 8. 6d. The object of this invention is to render the movements of the needle of the ordinary speaking needle instrument perceptible to the ear, as well as to the eye, so that those engaged in working it may be enabled to read the words received in the instrument by sound, as well as by sight. Fig. 1 is a front view of a single needle instrument with the improvements; fig. 2 is a side elevation of the same; fig. 3 represents a front and end view of the needle separately; fig. 4 the piece of resonant substance hereinafter called the resonator; fig. 5 is an enlarged oblique view of one of the wire clips for holding the resonator. A indicates the needle on the face of the instrument; B a piece of thin, light resonant substance called the resonator, for which it is preferred to use mica, although many other substances will answer the purpose, but none answers so well as mica, the highly resonant quality of mica, together with its lightness, transparency, and its independence of atmospheric conditions, render it admirably adapted for the purpose. This resonator is shown at B, in figs. 1 and 2, attached to the needle, and bent into an arched form, and thus retained in a state of tension, by which its power as a reinforcer of sound is increased. It is also shown on fig. 4, detached and flat. It is preferred to attach the resonator to the needle by one of the methods shown in the drawings, and it is desirable that such attachments should be very light, so as not to lessen more than is necessary the sensitiveness of the needle, and yet that they should be tolerably firm so as to hold the mica firmly and steadily, notwithstanding the jar produced by the striking of the needle against the stop-pins, *c*, *c*. For this purpose it is preferred to employ double-loop wire clips, *d*, *d*, of the form shown on an enlarged scale in fig. 5, and which are soldered or riveted to the needle through holes pierced partly in small lugs formed for the purpose on the sides of the needle, so as to give it extra width at those points. The two stop-pins are made of different materials, as for instance, one of brass and the other of ivory, or one of ivory and the other of glass or porcelain, so that the sound produced by the needle striking them may be different. Holes may advantageously be punched in the needle, as shown at *s*, *s*, in figs. 1 and 3, to lessen its weight.

FIG. 1.

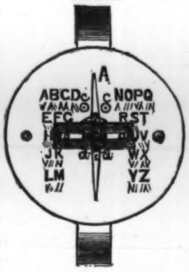


FIG. 2.

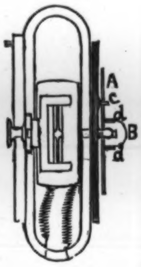


FIG. 3.

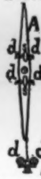


FIG. 4.

FIG. 5

4299. "Accumulators or secondary batteries." W. A. BARLOW. (Communicated from abroad by Messrs. L. Encausse and Canésie, of Paris.) Dated September 9. 4d. Consists in an improved accumulator which does not contain any liquid, and which may be constructed at a trifling cost and gives out all the electricity which has been accumulated in it, and it is called a dry accumulator on account of it not containing any liquid. It is constructed as follows: A certain number of pipes or metallic sheets are placed in a convenient receptacle, all these pipes or metal sheets are in communication by means of two metal plates which serve to make them fixed, and a plate of indiarubber or of any other insulating substance separates this first system from a second one constructed in quite the same manner. One pipe of each of these two systems is in communication with a terminal. When the apparatus so constructed is put in place in its receptacle the latter is filled up with any kind of salt, viz., chloruret of sodium, chloruret of calcium, sulphides, and so on, but the chloruret of sodium is preferable on account of its cheapness and some special and convenient qualities. It is important the salt be damp to a certain extent; this may be done if necessary by means of one or two cloths placed at the top of the said apparatus, which is then complete.

4303. "Electrical storage batteries." E. FRANKLAND. Dated September 9. 4d. Consists, firstly, in hardening oxide of lead upon the metallic or other plates of storage batteries, whether perforated or not, and either on the whole surface of the plate or in the perforations only, so as to cause it to attach itself firmly to the surface of the plate without the use of felt or other similar retaining fabric; and secondly, where perforated plates are used in piercing the coating material with holes through the perforations of the plates, so as to establish numerous liquid connections between the two sides of the plate, and thus promote a more free circulation of the electrolyte.

4304. "Electric lamps." J. G. STATTER. Dated September 9. 4d. Relates to improvements in electric lamps, the object of the improvements being to insure the gradual feeding of the carbons as they are consumed without intermittence or irregularity, to allow the lamp to be automatically cut out of circuit when the carbons are consumed, and to extinguish any lamp or lamps out of a number in series at will without interrupting the main current. (*Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.*)

4316. "Secondary or storage batteries." F. J. CHEESBROUGH. (Communicated from abroad by A. K. Eaton, of America.) Dated September 11. 6d. The object of this invention is to obtain the greatest amount of service in the storage reservoirs with the least possible weight, and to give the greatest possible efficiency to the same. A skeleton plate is formed of very thin sheet lead, which acts mainly as a conductor, or the skeleton may be an open wicker work of lead wire for the same purpose. The skeleton is filled in and entirely embedded in very fine spongy crystalline lead by the following treatment. Two pieces of sheet zinc are first prepared by coating each, on one side, with japan, or any varnish that will protect the surface. One of these sheets is then placed with the naked side of the zinc upwards in a shallow platter, the lead skeleton is placed upon this, the other zinc sheet is placed with its naked side downwards upon the lead skeleton. There is then poured into the platter a sufficient quantity of a saturated solution of acetate of lead, or its equivalent, to cover the lead network. In a short time the lead of the acetate is deposited on both sides of the lead skeleton, so as to entirely envelope it with lead sponge. The lead plates thus prepared, after washing, are pressed between two sheets of paper, parchmentised paper, cloth, asbestos board, or other material (asbestos being preferred). These inclosing sheets of asbestos with the included lead sponge are then ready for use.

CITY NOTES, REPORTS, MEETINGS, &c.

The Indo-European Telegraph Company (Limited).

THE sixteenth ordinary general meeting of this company was held at the Cannon Street Hotel, on Monday, Colonel James Holland, the Chairman, presiding.

The managing director (Mr. W. Andrews) read the notice convening the meeting, and

The Chairman formally affixed the seal of the company to the register of shareholders.

The directors' report, which we published in our issue of the 21st ult., having been taken as read,

The Chairman said:—The report is a little longer than usual, but happily it is not, as long reports very often are, an indication of coming disaster. I have observed that long reports are generally intended to explain deficits, but our report is not so, and is of a much more satisfactory nature. There is no necessity for my entering into the report at very great length, but I should like to say a few words with regard to it. You will observe that we made in round numbers, £118,000 in the past year, against £101,000 in the preceding year. That considerable increase of revenue was due, as we state in the report, entirely to the war in Egypt. During that war the wires of our friends, the Eastern Company, were totally cut down and destroyed for a period of some months, and it fell upon us therefore to conduct the entire telegraphic communication between England and India, Trans-India, including China and the Cape of Good Hope, Southern Africa, a province lying entirely out of our ordinary beat, and strange to say the urgencies of the case were such that a great many communications for Egypt itself were transmitted by us *viâ* India to Egypt. It was a singular instance of the great value of telegraphic communication, and I am happy to be able to say with that work the whole telegraphic business of the country was carried on without a hitch or a break, or any slackness or difficulty. (Hear, hear.) The extra work done was actually more than double that which we had done in the year before, although we did not derive the entire profit of all the extra work, consequent on our joint purse arrangement with the Eastern Company, an arrangement which has proved very beneficial to them as it has also proved very beneficial to us in past times and may do again; but this enormous increase of work, more than double as I have said than on the preceding year, was actually done with an increase of less than 1½ per cent. upon the total amount paid in salaries and wages in the preceding year. It is a strong additional instance of the value of telegraphic communication, showing how much may be done when once the plant is there and the establishments there, and provided also that both plant and establishments are good of their kind and are well managed; and I may say, without exulting too much on the part of the directors, that the business was very well managed, and I say so because the person who has the chief credit for that excellent management, who has seen to our plant, and trained our staff so that when the time of need came we were able to work efficiently, was my friend on the right, Mr. Andrews (hear, hear). Well, gentlemen, I might, by the way, in alluding to the dividend we are now about to propose to you, say that, although it is a very reasonably handsome one, the fact is, up to the present time, if you take the average of dividends we have declared since the first establishment of our company, you will find they have been under 4 per cent., so that although in point of fact a 9 per cent. dividend is a good thing, yet the average outcome of the affair up to the present time has not paid as much as we trust in a few years' time it will do. Among other items which we allude to in the report is that we have purchased a large quantity of stores and plant from Messrs. Siemens. It is a sort of difficult operation to purchase stores and see that they are all of a proper kind, considering they were spread over such enormous distances as in this instance—lines extending through Germany and Russia to many hundreds of miles. This work, however, was simplified by the excellent arrangements made by Messrs. Siemens, who, of their own accord, threw aside all obsolete and decaying material, and handed us over good working stuff, which we were only too glad to take. You must be aware that a certain amount of spare stores is absolutely necessary to the continuous working of any telegraph line, so we have taken over these stores without hitch or hindrance, without litigious spirit occurring on either side, and leaving I hope good feelings between both parties (hear, hear). Among other matters we have to mention—a matter of satisfaction—is the renewal of the Prussian concession for ten years. Some difficulty was apprehended about this. It has taken a considerable time to bring it about, but at last the concession has been granted and on favourable terms. Our concession runs now, with all the different countries connected with the line for the full period of thirty-five years, and I see no reason why at the end of that time it may not be renewed for a still further term. We now come to a matter that I know has puzzled a great number of shareholders, namely, the Persian debt. You will find it referred to at the foot of the account under the head "Suspense Account": "To items paid towards the liquidation of the Persian debt in 1870, 1871, 1872, and 1873, being in the nature of a reserve fund, £9,586 15s. 3d." The difficulty connected with this is in reality very small if you will only take the trouble to go into it. I will endeavour to give you an idea what the Persian debt was. The line through Persia which necessarily connects our line through Germany, Russia, and the East was constructed for the Persian Government by the Indian Government, and cost £47,000 and some hundreds, so after many arrangements—and many had to be made between the three parties, the Persian Government, the Indian Government, and ourselves—it was agreed that this £47,000 odd should be paid by Persia to India in the following manner: First of all we agreed to pay annually a portion of the tribute or royalty which was due by us to Persia to the Indian Government instead of to Persia. That money will amount to about £23,000. It is a matter of no concern to us whether we pay it to Persia or to India, but the balance of this account we agreed should be taken from our profits on the line and paid over to the Indian Government; and the Persian Government on their behalf stated that when this was paid off, we might go on deducting the amount year by year from the tribute payable to them until we had recouped ourselves. In the year 1874 we had paid £9,000 odd out of our profits. We were then unfortunately in a sad state of impecuniosity, and found it difficult to keep up these payments, and the Indian Government obligingly deferred exacting the remaining sum from us until we were in better circumstances. Last year they claimed performance of the agreement, and we handed over to them the amount of profit on the Persian line, which you will find amounts to £6,146. There still remains a sum of about £5,700 payable, which, no doubt, will be paid out of the profits of the present year. After that payment, our payments will come to an end, and thereafter, for the next eleven years, we shall recoup ourselves by the receipt of nearly £2,000 a year until the whole of our advances on behalf of Persia have been paid off. We shall therefore, commencing from the year 1884, actually be in receipt of nearly £2,000 a year for eleven years more than we have been hitherto, and we consequently state that this will be in the nature of a reserve. I am afraid I have not made myself thoroughly intelligible to some of you, but I may say if any gentleman is such a glutton for figures that he is desirous of seeing the minutiæ of this statement, if he will apply to our excellent, efficient, and courteous accountant, Mr. Kemp, I am sure he will receive from that gentleman sufficient information to satisfy the most rabid appetite for figures, and an explanation up to the last farthing as to how this somewhat complicated account has been made out. Among other matters that we have to mention is the cable conference at Paris. When I addressed you last year, I had to speak in somewhat disparaging terms of the delay and difficulty we had met with owing to injuries to the various submarine cables. The Government at last, after some pressure, took up the subject and entered into communication with Foreign Governments, and a conference was held at Paris, and sundry agreements made which we hope will be fully carried out and put an end to the various causes of complaint. I have only further to mention that you will see that we have in one way or the other carried rather more than usual to our reserve fund this year. We have £5,000 of actual cash payment, as it were, but we have other sums in the nature of a reserve. There are the stores and freehold buildings taken over from Messrs. Siemens. Instead of spreading the payment over a period of years, we thought it desirable in your interest it should be paid over at once. It is part of the policy we have always adopted, since we have had the means of doing it, to pay the cost of everything in the year in which it has arisen, so as to leave a free and a clean balance sheet. I think you will admit that the state and value of our property in the market at present justifies the conduct that we have hitherto, with your sanction, followed in this particular. The shares now stand at a very high figure, because we have paid sums as they have fallen due and because we have instituted a reserve fund which I hope and trust will yet rise to a very much higher figure. I have no further remarks to make, except in reply to any questions any gentlemen may ask. I now move that the report and statement of accounts be received and adopted.

Mr. H. Weaver seconded, and the motion was unanimously agreed to.

The Chairman next moved that a dividend be declared for the half-year ending 31st December last at the rate of 17s. 6d. per share, making, with the interim dividend already paid, 6 per cent. for the year, and a bonus of 15s. per share, both free of income-tax, in all 9 per cent. for the year.

Mr. J. H. Tritton seconded, and this motion was likewise adopted.

Major-General G. B. Tremenheere and Mr. J. H. Tritton, the retiring directors, were re-elected, as were also the auditors, Messrs. C. F. Kemp, Ford & Co.

A vote of thanks to the chairman and directors closed the meeting.

The Eastern Extension, Australasia, and China Telegraph Company.—This company has intimated that the coupon on its Five per Cent. Manila Debentures, due on the 1st inst., will be paid at the Consolidated Bank, 52, Threadneedle Street, E.C. Coupons should be left three clear days for examination.

The Eastern Telegraph Company.—This company announces that the Eastern and South African Telegraph Company's Mozambique-Zanzibar cable is again interrupted.

Wreck of a Telegraph Cable Steamer.—A Lloyd's telegram received from New York states that the steamer *Professor Morse*, 1,023 tons, employed in telegraph cable laying, whilst on a voyage from New York to Boston, ran ashore on Block Island, Rhode Island, and is full of water. The vessel has been abandoned, it being found impossible to save her.

Personal.—We are informed that Mr. Cordner, general manager, and Mr. Allen, chief electrician, of the Anglo-American Brush Company have both resigned their respective positions.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid	Closing Quotations. May 2.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	7	4¾- 5¼	5 5/16.3/16.⅛.5
		Do. Do.	10	7 - 8	7½
30,000	5	Australasian Electric Light, Power & Storage Co.	3	¼- ⅜	
24,900	10	British Insulite Co., Limited, "A" Shares	5	1½- 2½	
30,000	5	Brush Electric Light & Power Co. (Scotland)	2½	[illegible]	
25,000	5	Great Western Electric Light & Power Co.	2½	[illegible]	
24,980	5	Hammond Electric Light & Power Supply Co.	2½	2½- 3½	3
40,000	5	Indian & Oriental Electrical Storage Works Co.	2	[illegible]	
172,500	1	Maxim-Weston Electric Light and Power Co.	1	⅛- ⅜	
..	..	Metropolitan Brush Electric Light & Power Co.	3	..	
40,000	5	Pilsen-Joel & General Electric Light Co.	2	⅛- ⅜	
..	..	South African Brush Electric Light & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Limited	2½	1⅞- 2⅛	
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	51 - 52	51¾
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until	100	83½- 84½	84.⅛.¼
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c. has been paid to Pref.	100	21 - 21½	21⅛.¾.11/16
130,000	10	Brazilian Submarine, Limited	10	12½- 12¾	10¾
16,000	10	Cuba, Limited	10	10 - 10½	
6,000	10	Do. 10 per cent. Preference	10	17 - 18	
13,000	10	Direct Spanish, Limited	9	5¼- 5¾	
6,000	10	Do. 10 per cent. Preference	10	16 - 16½	
65,000	20	Direct United States Cable, Limited, 1877	20	12¾- 13	12 15/16.⅞.¾ xd
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	99 -102	
380,000	10	Eastern, Limited	10	10¾-11	11.10 15/16.⅞
70,000	10	Do. 6 per cent. Preference	10	13¼- 13¾	13½.7/16
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	98 -101	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	104 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	12 - 12¼	12 3/16.¼ x.l. & bonus
50,250		Do. New Shares, 1883	8	8⅞- 9⅛	
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	107 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	104 -107	
140,000	100	Do. do. registered, repayable 1900	100	104 -107	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101 -104	xd.
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	104 -107	
345,700*l.*	100	Do. do. do. To Bearer	100	104 -107	
22,050	10	German Union Telegraph and Trust, Limited	10	10 - 10½	10⅜
163,390	10	Globe Telegraph and Trust, Limited	10	7⅛- 7⅜	7⅜.¼.5/16.⅜.xd
163,206	10	Do. 6 per cent. Preference	10	12⅞- 13⅛	13.⅛.3/16.⅛.xd
125,000	10	Great Northern	10	13¼- 13½	13⅛ xd
100,000*l.*	100	Do. 5 per cent. Debentures	100	101 -104	102⅜ xd
300,000	100	Do. 5 per cent. Debentures	100	101 -104	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	28½- 29½	
100,000	100	Do. 6 per cent. Debentures, 1886	100	103 -106	
17,000	25	Indo-European, Limited	25	33 - 34	
38,148	10	London Platino-Brazilian, Limited	10	4¼- 4¾	
12,000	10	Mediterranean Extension, Limited	10	1¾- 2¼	
8,200	10	Do. 8 per cent. Preference	10	6 - 7	
9,000	8	Reuter's, Limited	8	9½- 10	xd.
280,000	Stk.	Submarine	100	247 -252	250½
58,225	1	Do. Scrip	1	2 - 2¼	
4,200	Cert.	Submarine Cables Trust	100	108 -112	
37,350	12	Telegraph Construction and Maintenance	12	35½- 36½	36.5¾.6¼
150,000	100	Do. 6 per cent. Bonds, 1884	100	101 -103	
186,750	5	Do. 2nd Bonus Trust Cert.	2½	1⅝- 1⅞	ex. c. 16
30,000	10	West Coast of America, Limited	10	4½- 5	
150,000	100	Do. 8 per cent. Debentures	100	107 -109	
69,910	20	Western and Brazilian, Limited	15	7⅛- 7⅜	
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	106 -110	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	100 -103	101½
1,500	$1,000	Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds.	$1,000	122 -124	124¾ xd
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	103 -106	
88,321	10	West India and Panama, Limited	10	1¼- 1¾	
34,563	10	Do. 6 per cent. 1st Preference	10	7¾- 8¼	
4,669	10	Do. 6 do. 2nd do.	10	5¾- 6¼	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	⅛- ¼	⅞.13/16
225,000	1	Oriental Telephone Co., Nos. 80,001 to 300,000	½	¼- ⅜	xd.
100,000	5	United Telephone Co.	5	9¾- 10¼	10.9 15/16.⅞.10

Ayrton v. Paterson & Co.—In the Chancery Division of the High Court of Justice on Thursday, Mr. Justice Pearson again had before him the motion to restrain the defendants, who are electrical engineers, carrying on business at Little Britain and Dalston, from selling, contrary to their agreement with the plaintiffs, Professors Ayrton and Perry, certain instruments, ammeters, voltmeters, and other contrivances invented by the plaintiffs for measuring electric currents, resistance, and the like, without having previously submitted the same to be tested by the plaintiffs. Mr. Cookson, who appeared for the plaintiffs, explained that the parties had arranged that the motion should again stand over for hearing, the defendants meantime undertaking to keep an account of all the instruments in question sold by them, and to cease advertising them.

Rival Telephone Companies.—In the case of the United Telephone Co. against the Long-Distance Telephone Co., Mr. Justice Chitty, in the Chancery Division on Thursday, gave leave to serve a short notice of motion for an injunction for yesterday.

PATERSON & COOPER

(LATE EDWARD PATERSON),

ELECTRIC LIGHT & POWER & TELEPHONE ENGINEERS,

St. Paul's Works—76, LITTLE BRITAIN, LONDON, E.C.,

AND

European Telegraph Works—POWNALL ROAD, DALSTON.

Prize Medals, International Electrical Exhibitions, Paris, 1881, and London, 1882.

MANUFACTURERS OF

DYNAMO MACHINES, ARC LAMPS, SWITCHES,

AND ALL FITTINGS FOR ELECTRIC LIGHT INSTALLATIONS.

SOLE MAKERS OF AYRTON AND PERRY'S ELECTRIC CURRENT METERS.

AYRTON & PERRY'S

Ammeter.

Ohmmeter.

Power Meter.

Voltmeter.

Kidsforth's

R. E. Switches.

Telephones.

Transmitters.

Switchboards.

Batteries.

Insulators.

Magneto Call Bells.

Electric Signals.

MUDFORD'S IMPROVED THOMSON'S REFLECTING GALVANOMETER.

SPECIAL ELECTRICAL TEST INSTRUMENTS FOR ELECTRIC LIGHT COMPANIES.

ELECTRIC LIGHT LEADS, GUTTA-PERCHA, INDIA-RUBBER COMPOUND BRAIDED COTTON, SILK-COVERED WIRES.

SPECIAL WIRES FOR DYNAMO MACHINES.

PHILLIPS BROS.,

ELECTRICAL WIRE MANUFACTURERS,

THE LEA TELEGRAPH WORKS, HACKNEY WICK,

LONDON,

FORMERLY OF

MACINTOSH LANE, HOMERTON.

ESTABLISHED 1870.

SPECIAL WIRES FOR INCANDESCENT LAMPS.

GERMAN SILVER WIRES FOR HIGH RESISTANCES, FLEXIBLE CORDS, TELEPHONE WIRES, &c., &c. MULTIPLE, AERIAL, AND SUBTERRANEAN CABLE WIRES TO ANY SPECIFICATION.

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Works: Silvertown, Essex; Persan-Beaumont, France.

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OF

CABLES.—Submarine, Subterranean, and Aerial.

WIRE.—India-Rubber and Gutta-Percha covered in all gauges.

INSTRUMENTS.—"Morse," Relays, Single Needle, Wheatstone's Alphabetical, Semaphore "Block" Instruments, Bells, Resistance Coils, Sir W. Thomson's and other Galvanometers, Condensers, Testing Instruments, &c.

BATTERIES.—SOLE MANUFACTURERS FOR GREAT BRITAIN, IRELAND, AND THE COLONIES OF THE CELEBRATED LECLANCHE BATTERY, which has received the most favourable reports from the Postal Telegraph Authorities and other eminent Telegraph Engineers, and is now in general use by the Post Office and English and Continental Railways. As a Battery for all Telegraphic purposes it is undoubtedly pre-eminent. All other kinds of Batteries also manufactured. Ebonite Cells, Carbon Plates, &c.

INSULATORS.—Ebonite, Porcelain, Brownware, &c.

MANUFACTURERS OF THE MOST IMPROVED APPARATUS FOR RAILWAY BLOCK-SIGNALLING.

SEMAPHORE REPEATERS, "LIGHT" INDICATORS, AND WALKER'S "PASSENGER AND GUARD" COMMUNICATOR.

TELEGRAPH STORES AND APPARATUS OF EVERY DESCRIPTION.

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A Constant Battery for Mining and Blasting Purposes.

CONTRACTS ENTERED INTO for the SUPPLY, CONSTRUCTION, and MAINTENANCE of TELEGRAPH LINES.

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INDIA RUBBER MACHINE DRIVING BANDS.

WATERPROOF GARMENTS AND FABRICS:

Coats, Capes, Leggings, Hats, Helmets, Knee Wrappers, Diving Dresses, Sheeting for Hospitals, Water and Air Proof Beds, Pillows, Cushions, Bottles, Baths, Life Belts, Gas Bags.

EBONITE.

Not affected by Vinegar or Hydrochloric or Acetic Acid.

Pumps.
Photographic Articles.
Speaking Tubes, Mouthpieces.
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